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ABSTRACT

This paper, one of a series from the Western Interstate Commission for Higher Education's project "Higher Education and the Economy of the West," surveys the literature on all aspects of the relationship between higher education and the economy, and the teaching, research, and service missions of the academy, with special attention to reports and policy documents prepared by federal and state governments and independent and multistate development organizations. The paper addresses issues including the education challenges posed by a global economy, the essential education skills that workers will need, the role of technology in education and the economy and infusing internationalism and multiculturalism into the educational experience. Publications by economists, education scholars, policy experts, government panels, and higher education and economic agencies are reviewed. Topics addressed and sources cited include: characteristics of the "new" economy and the changing workplace; infrastructure and human resource development; putting research and development to work; expanding access to education; serving underrepresented racial and ethnic populations, working adults and lifelong learners, and rural populations; using technology to improve educational delivery; distance learning; improving undergraduate and graduate education; balancing liberal and professional education; strengthening general education; multiculturalism; internationalism; creating an active learning environment; improving the status of teaching as a profession; math and science education in the public schools; restructuring teacher education programs; university/school partnerships; university research, and collaboration with business and industry; managing university research; financing higher education; new tuition and financial aid models; and managing resources. (Contains approximately 200 references.) (CH)

HIGHER EDUCATION

and the Economy of the West

Working Paper #2

Exploring the Relationship:

A Survey of the Literature on Higher
Education and the Economy

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Exploring the Relationship:
A Survey of the Literature on
Higher Education and the Economy

Higher Education and the Economy of the West

**Western Interstate Commission for Higher Education
P.O. Drawer P, Boulder, Colorado 80301-9752**

Partial financial support was provided by The Ford Foundation

This is the second working paper for the WICHE project "Higher Education and the Economy of the West." It provides a survey of the literature on the relationship between higher education and the economy, and a discussion of higher education reforms.

The project focus is an examination of the broad relationship between higher education and the economy and the ways in which higher education in the 16 WICHE states must change in order to be more responsive to the needs of the region in the 1990s and beyond.

This paper was prepared by the Office of Research and Policy Analysis of the Western Interstate Commission for Higher Education (WICHE). Comments on the paper should be addressed to Judith I. Gill, Director, Office of Research and Policy Analysis, WICHE, P.O. Drawer P, Boulder, CO 80301-9752, (303) 541-0224.

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FOREWORD

This working paper is part of the Western Interstate Commission for Higher Education's (WICHE) project "Higher Education and the Economy of the West," partially supported by The Ford Foundation. This paper explores the relationship between higher education and the economy through a survey of recent literature in the area and discusses ways in which the relationship can be strengthened.

Robin Etter Zúñiga, research associate in the WICHE Office of Research and Policy Analysis, had primary responsibility for reviewing the literature and drafting the paper. Kelly Zweifel, senior secretary, conducted bibliographical searches and located materials. Deborah Evans, free-lance editor, provided valuable editorial assistance and Cherie Pedersen, senior secretary, prepared successive drafts of the paper.

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November 1992

This working paper is one of six publications resulting from the WICHE project, "Higher Education and the Economy of the West." Much has been written in recent years about the relationship between higher education and the economy, and the higher education reforms needed to respond to the emerging global economy and multicultural society. This component of the project surveys the literature on this subject and comments on how the relationship can be enhanced.

Bibliographical searches were conducted covering all aspects of the relationship between higher education and the economy, and the teaching, research, and service missions of the academy. Special attention was given to reports and policy documents prepared by federal and state government agencies and commissions, and independent and multistate higher education and economic development organizations.

Project Assumptions

Three primary assumptions have guided this project. The first is that the definition of higher education's contribution to the economy must be broadened. Often higher education's relationship with the economy is viewed within the narrow constraints of technology transfer and business-university alliances. In redefining the relationship, we return to the classic definition of the economy: the well-being of the majority of a society's citizens. When using this definition, the contributions that higher education makes to the economy include its connection with the public schools, the quality of undergraduate education, outreach programs for diverse racial and ethnic populations and rural areas, as well as research and development, technology transfer, centers of excellence, and specialized training.

The second assumption is that a change in state policies can serve to strengthen the relationship between higher education and the economy. Higher education must, therefore, work in coordination with state government to meet state economic needs.

The third assumption places the project in the context of fiscal constraints. Action taken by states and their colleges and universities is limited by the current austere financial climate. And because of fiscal limitations, cooperation and differentiation among institutions are more important than ever before.

Change is perhaps the most pervasive and unifying theme of the project papers. As the economy rapidly becomes global and interactive, our nation's colleges and universities must be prepared to meet the challenges of a transformed economy. Higher education will be required to continue to advance technology through research, to make greater use of limited resources through increased collaboration with public and private sectors, to be responsive to workforce needs, and to maintain educational quality and access for as broad a population as possible. If higher education can be characterized as having responded to the economy by taking small steps in primarily one direction, WICHE is

advocating giant steps in some new directions. In the words of Clark Kerr, "The major test of a modern American university is how wisely and how quickly it adjusts to important new possibilities" (Kerr, 1977: 108).

WICHE's Perspective

Given its history of regional cooperation, WICHE's inclination on this project was to look for ways in which higher education can work in concert with the public schools, business and industry, local and state government, and the community to meet emerging economic needs.

The WICHE Commissioners, representing 16 western states, determined the project agenda, particularly its policy focus. While the Commissioners adopted a regional policy perspective for this project, they also understood that blanket recommendations are not possible or practical. Rather, general direction and insights on regional changes should play a role in determining a state's higher education agenda.

Project Components

In order to set boundaries on a project of this size and scope, we began with a list of 10 critical issues that have an impact on higher education's role in the economy:

1. Quality Undergraduate Education
2. Higher Education and Public School Connections
3. Educational Progression of Racial and Ethnic Minorities
4. State Higher Education Funding Priorities
5. Alternative Educational Delivery Systems
6. International Education
7. Differentiation of Institutional Roles and Missions
8. Identification and Development of Academic Programs to Meet Workforce Needs
9. Higher Education Research
10. Strengthening the Relationship Among Higher Education, Government, and the Private Sector

The critical issues and the project activities — a collection of economic and educational data, survey of recent literature, sampling of exemplary programs, interviews with participants and observers of education, economic, and governmental systems, and a review of state economic development and higher education master plans — defined the project scope. As the various project activities were undertaken and after several conversations with higher education policymakers, the critical issues remained virtually the same but their focus changed to reflect what was learned. Individual project undertakings by themselves did not reveal fully the higher education-economy relationship; however, like pieces of a mosaic, when viewed as a whole, they became a powerful picture and allowed significant insight.

The following is a list of the working papers and the final report resulting from WICHE's "Higher Education and the Economy of the West" project. The working papers serve as a foundation for the final report — much of the policy analysis and observations in the final report are based on information from the five working papers.

- *A Region of Contrasts: An Educational and Economic Profile of the West (Working Papers #1a and #1b)* are a presentation and analysis of demographic, workforce, and educational data for 16 western states. Data including employment by sector, educational attainment, foreign exports, and the location of higher education institutions in relation to population centers are examined at a regional level in Part One of the report. In Part Two, select economic and educational characteristics are reported for each western state.
- *Exploring the Relationship: A Survey of the Literature on Higher Education and the Economy (Working Paper #2)* is a survey of recent literature on the relationship between higher education and the economy and a commentary on how this relationship can be enhanced. The paper addresses issues including the education challenges posed by a global economy; the essential education skills that workers will need; the role of technology in education and the economy; and infusing internationalism and multiculturalism into the educational experience. Publications by economists, education scholars, policy experts, government panels, and higher education and economic agencies are reviewed.
- *The Higher Education-Economy Tie: A Sampling of Exemplary Programs in the West (Working Paper #3)* is a review and analysis of more than 30 exemplary programs in the West that illustrate higher education's contribution to the economy. Programs fall into five categories: (1) school-university partnerships; (2) government-university initiatives; (3) small business outreach; (4) technology transfer and workforce training; and (5) rural or underserved population outreach.
- *Insights on the Higher Education-Economy Relationship: Interviews with the Stakeholders (Working Paper #4)* is a summary of interviews with a small group of knowledgeable and experienced participants and observers of education, economic, and governmental systems. The interviews sought their insight on what issues must be addressed if higher education is to be responsive to economic needs in the 1990s and the 21st century. The paper summarizes interview conversations and is organized around four general themes: planning for the future; responding to the public and serving a new student clientele; effective collaboration; and the relationship of curriculum reform to faculty productivity and rewards.
- *Joined or Unconnected? A Look at State Economic Development and Higher Education Plans (Working Paper #5)* is a summary and analysis of the most recent state higher education master plans and economic development plans in the 16 WICHE states. The plans were reviewed with an eye toward noting how they relate to each other — that is, in what ways the statewide higher education plans articulate and address concerns with economic planning and development, and in what ways the economic plans articulate and address concerns with higher education planning and development.

- *Meeting Economic and Social Challenges: A Strategic Agenda for Higher Education (Policy Recommendations)* is the final report of the project. It presents project conclusions and a series of recommendations to state legislators and higher education policymakers. Included in the policy option discussion are implementation issues and examples of states and institutions currently making the recommended policy changes.

The world in which the United States easily dominated its competition in production and technology no longer exists. American corporations and workers face stiff global competition for markets and jobs. Between 1974 and 1988, the United States lost one-half of all routine steelmaking jobs. During the 1980s, General Motors alone cut 150,000 production jobs in the United States. These cuts have affected everyone involved in the production of goods, including lower- and middle-level managers (Reich, 1991a).

In order to compete, U.S. business is adapting to a "global marketplace," in which products, resources, information, money, and ideas move rapidly across international borders. The corporation itself has evolved into a "web" of small production, design, marketing, and related enterprises located throughout the world. More than one-half of America's exports and imports can be traced to the transfer of goods and related services within these "global webs" (Reich, 1991b).

More and more a corporation's ability to compete depends on the skills of its workers. The need for rapid responses in the "global marketplace" requires not only a thorough knowledge of the content of the jobs they perform but also competency in communications, problem-solving skills, and interpersonal relations (Reich, 1991b; Thurow, 1992; Commission on the Skills of the American Workforce, 1990).

At the same time, the U.S. is experiencing dramatic demographic changes. Between 1980 and the year 2000, the 16-to-24-year old population will decline by 8 percent (or approximately two million people). The labor force also is becoming more diverse. By the turn of the century, 83 percent of new entrants to the labor force will be women, non-Whites, and immigrants (Hudson Institute, 1988). The general decrease in young workers, and the increasing proportion of workers who traditionally have been underrepresented in education (African-Americans, Latinos, and Native Americans), is leading to a shortage of skilled workers at a time when higher order skills are increasingly in demand.

Unfortunately, access to educational opportunities is not equally distributed. African-Americans, Latinos, and Native Americans, who make up an increasing proportion of the workforce, have been underserved by the nation's educational system. These groups tend to have higher than average high school drop-out rates and lower than average rates of postsecondary attendance and completion. Moreover, traditional higher education delivery systems frequently lock out place-bound students in rural areas and non-traditional students who juggle family, work, and school. Educators must continue to explore new ways to improve recruitment and retention and to develop alternative delivery systems for underserved populations.

As higher order skills become crucial to economic competitiveness and the number of young workers decreases, educational quality becomes a top priority for American businesses. However, how we define and measure quality is a subject of debate. Should

all students, regardless of their academic goals, be required to complete a core liberal arts curriculum, and if so, what would this curriculum include? Should the study of foreign languages and cultures, and of the multicultural experience within the United States, be required of all students? Does today's technical training provide the skills needed in today's workplace? How can all students — whether they are pursuing academic, professional, or technical degrees — be given the opportunity to develop problem-solving, interpersonal relations, and communications skills?

Through its preparation of teachers, higher education has a significant impact on the ability of the elementary and secondary education system to prepare students for the labor force and postsecondary education. As the skills needed by the labor force increase and the nation's school-age population becomes increasingly diverse, teachers also must develop new competencies in problem solving, understanding cultures other than their own, and the uses of educational technologies. Schools of education are exploring the nature of these new competencies and how best to prepare tomorrow's educators. Some now require that educators complete a liberal arts curriculum before focusing on professional training. All are concerned with how educators learn to operate effectively in the multicultural classroom.

In addition to teaching — higher education's most basic function — the research and service functions of higher education have a significant impact on the nation's economy. Through their experiment stations and state cooperative extension services, the land-grant university supplied the research and technology transfer that made the United States a leader in agricultural production. Further, following World War II compulsory mass elementary and secondary education was mandated, thus enabling U.S. industry to use technologies that outstripped human talent in other countries. Consequently, "American firms did not compete with foreign firms, they built products no one else could build" (Thurow, 1992: 154; Boyer, 1990).

Higher education can be a significant force when presented with compelling problems. However, since man first walked on the moon, the sense of urgency and focus that drove much of the involvement of universities in research has dissipated. At the root of the problem is a faculty incentive and reward structure that emphasizes excellence in basic research. Faculty learn early in their careers that quality teaching, applied research, and public service do not lead to professional recognition or success. With the possible exception of medical research, the impetus for much research work comes from the professional rewards associated with expanding the base of knowledge in the disciplines rather than with solving societal problems. To effectively meet the challenges of the new economy and society, institutions of higher education must balance their teaching, research, and service missions, and identify their role in developing effective partnerships with business and industry.

Higher education's pursuit of this agenda is hindered by fiscal constraints. As federal funding has been curtailed and demands on limited state resources have increased, states have used public higher education as a "budget balancer." Although higher education is

an active participant in the economic life of local, state, regional, and national economies,¹ its leaders have not always clearly articulated this relationship. Public higher education, therefore, fares poorly when competing with corrections, health and social services, and other public services. As a result, public higher education is becoming more dependent on private grants and contracts, and student tuition revenues; and is being forced to carefully balance demands for mass education, excellence in basic and applied research, and public service.

The following literature review surveys the issues that underlie discussions about the relationship between higher education and the economy, and provides a commentary on ways in which the relationship can be enhanced.

¹ According to Leslie and Brinkman, "[f]or each dollar in a college's operating budget...approximately \$1.50-\$1.60 of local business volume is created. For each \$1 million...about 59 jobs are created" (Leslie and Brinkman, 1988: 13).

II.

THE NEW ECONOMY: PROBLEMS AND PROSPECTS

The once dominant position of the United States in the world economy has eroded. Overall growth in the productivity of American business and industry has declined — from an average of 3 percent per year for the past 150 years to an average of 1.2 percent per year between 1980 and 1990². Our largest competitors, Japan and Europe, have acquired increasingly larger shares of the world market in basic industries such as automobiles and steel, and are increasing their share of high technology markets. Consequently, America's share of the world gross national product (GNP) fell from well over one-half in the 1940s to 22-23 percent in the late 1980s. Real wages have declined as a result, and more and more workers in the United States are finding themselves unemployed or underemployed. Due to the loss of high-wage manufacturing jobs (steel, autos, and machine tools) in the 1980s, male wages fell 9 percent in real dollars. American families compensated for this decline by becoming two-income households. With most American women now employed full-time, the American family's standard of living will be seriously impacted by further declines in real wages (Thurow, 1992; Carnevale, 1991; Commission on the Skills of the American Workforce, 1990).

Rural economies are often the hardest hit. A report commissioned by the Western Governors' Association concludes, the disparity in population growth and income in urban versus rural areas has led to the phenomenon of "two economies" within states in the West. Due to a reduction in the use of raw materials in production and increased competition from the Third World, rural economies dependent on resource-based industries (agriculture, timber, and mining) have been in steady decline since the early 1980s. Loss of jobs and income in these industries has led to a loss of tax revenue, and a string of bank failures³. Consequently, these communities lack the fiscal capacity to invest in the technical infrastructure and educational programs needed to compete in the new economy. As job opportunities dry up, talented individuals move to urban settings where the growing service- and technology-based industries are located, leaving rural communities without the skilled workers and public leadership they need to attract new industries (Thurow, 1992; Cooperative Extension System, 1986; Western Governors' Association, 1988).

How can the United States pull out of this economic slump? Most economists and policymakers agree about the basic characteristics of the new economy and the three areas in which the United States economy is most in need of improvement: capital investment, technological innovation, and human resource development. Discussions about capital investment are the most politically charged, with widespread disagreement about the effectiveness of policies intended to improve the productive investment of capital (e.g., capital gains taxes, government regulation of financial institutions, interest rates, and foreign investment in the U.S. economy). There is, however, general agreement

² Between 1989 and 1990 productivity in the U.S. actually fell.

³ Two-thirds of the bank failures in the mid-1980s were in rural areas.

about the other two areas: the importance of human resource development; and the value of placing more emphasis on research and development, especially the more efficient transfer of technology from basic research to commercialization (see for example, Business-Higher Education Forum, 1983; Reich, 1991b; Thurow, 1991 and 1992; Carnevale, 1991).

Characteristics of the New Economy

In the postindustrial society of the late 20th century, national economies have given way to a global economy and the rules of competition have changed (Porter, 1990; Reich, 1991a and 1991b; Thurow, 1991 and 1992). These changes are, in turn, leading to changes in the processes of production, and the organization of work.

In the "global marketplace" capital, resources, and information travel around the world with little regard for national boundaries. American corporations increased their capital investment abroad by 13 percent in 1989 and by an estimated 17 percent in 1990. Foreign investment in the United States increased 12 percent in 1989, up \$2 trillion from the previous year (Reich, 1991a). Improvement in transportation means that countries without abundant natural resources no longer are prevented from being productive in manufacturing. The highly productive Japanese steel industry, for example, relies on iron and coal from other countries (Thurow, 1991 and 1992). Sophisticated telecommunications networks make it possible to employ the talents of individuals across the world in productive enterprises. A corporation in Paris can hire an engineer or designer in Los Angeles, who transmits specifications for a new product via satellite to a high resolution computer belonging to a manufacturing engineer in Seoul, who turns the specifications into a prototype which is then reproduced in Tokyo (Reich, 1991a).

These changes represent more than a global redistribution of productive capacity. They are signs of underlying changes in the rules of competition. Anthony Carnevale defines five new competitive standards for the late 20th century: quality, customization, convenience, customer service, and timeliness (Carnevale, 1991). In the industrial economy of the early 20th century the rules of competition dictated that standardized products be made in high volumes at the lowest possible cost. In contrast, today's market is driven by a consumer who demands high quality products tailored to particular needs, convenience, and the best in customer service. Sophisticated technologies make it possible for companies to tailor high quality products and services to specific market niches while improving overall productivity (Reich, 1991b; Carnevale, 1991).

Carnevale also points out that the traditional economic "life cycle" (innovation, installation, competition, maturity, break-through to new economic "life cycle") no longer applies. Global corporations are known to skip the first step, borrowing innovations from elsewhere and moving directly to more commercial phases (Carnevale, 1991). Many of the new information technologies, such as facsimile machines and VCRs, were invented in the United States. By using superior production technologies, which improve speed and quality control, foreign competitors have been able to capture the largest share of the markets for these products (Thurow, 1991). Efficient use of resources and keeping costs

down are important. However, improving productivity today depends more on innovations in the production process, than on introducing new products (Carnevale, 1991; Reich, 1991b; Thurow, 1991).

The Changing Workplace. American corporations traditionally have given autonomy only to the most highly skilled employees and upper management. Decisions on production processes usually have been made through top-down hierarchies. Employees working at the point of production have been given little or no autonomy or control over the production process. In the new economy, this form of organization is counterproductive. Successful managers realize that most improvements in productivity take place through incremental changes in the production process at the point of production. When workers at the point of production must first turn to a hierarchical decisionmaking process, valuable time is lost in the installation of innovations, making continuous improvements, and learning new applications. Top-down hierarchies and inflexible, isolated organizations are being replaced by flexible networks in which hierarchies are flattened: companies are sharing the cost of research, human resource, and technological development; and production decisions are being pushed down the line to work teams that make the products and serve customers (Reich, 1991b; Thurow, 1991; Carnevale, 1991; Commission on Skills of American Workforce, 1990).

As these changes are made in the organization of work, there will be an increased demand for higher level skills from all workers. Performing statistical quality controls, installing innovations, and making continuous improvements in processes at the point of production, service delivery, and customer service will require more sophisticated computational, oral and written communication, and problem-solving skills (Reich, 1991b; Thurow, 1991; Bailey, 1990; Business-Higher Education Forum, 1983). Recent surveys of business and industry support this view. A 1991 report by the U.S. Labor Secretary's Commission on Achieving Necessary Skills (SCANS) concludes "...good jobs will increasingly depend on people who can put knowledge to work" (U.S. Department of Labor, 1991: xv). These workers will need to acquire proficiency in basic skills, (reading, writing, performing computations, listening, and speaking), as well as be able to organize, think creatively, work well with others, and adapt to new situations and technologies. Other reports support these observations (Commission on the Skills of the American Workforce, 1990; Carnevale, 1988).

Investing in the Future

In order to become competitive federal and state governments, and business and industry must adapt. Several policy areas deserve attention: investing more heavily in the nation's infrastructure; developing human resources; and improving our research and development capacity, including placing more emphasis on the production process and improving the speed at which new innovations are transferred from the laboratory to the production process.

Infrastructure. Current financial difficulties, illustrated by the national debt and savings and loan and bank failures, impede the nation's ability to make necessary investments in infrastructure. There is widespread disagreement about how we can secure the necessary capital.

One side of the debate argues that the federal government cannot afford more investment in technical infrastructure or human resource development, and that excessive government spending limits the capital available for private investment. In this view, the role of government is to remove undue burdens on the private sector (e.g., loosening government regulation and relaxing the tax burden on capital gains), thus freeing up private capital (Business-Higher Education Forum, 1983).

The opposing view contends we cannot afford to ignore the need for government investment in the long-term economic growth of the nation. In the global society of the 1990s, money flows easily across borders. Capital in the hands of private investors, therefore, is as likely to flow abroad, as it is to be invested in the United States⁴. In this view, the government's role is to build and maintain the nation's human resources and infrastructure, and bargain for jobs and capital with global corporations. Public debt and increasing tax burdens on the wealthy are productive, so long as the funds are invested in the long-term economic growth of the nation (Reich, 1991a; Reich, 1991b).

Developing Human Resources. The United States has done a good job of training professional and technical elites. The quality of our higher education system is reflected in the large number of international students it attracts. Our competitors, however, are much better at educating the "middle 80 percent" of their populations. Japan requires a high level of training for all students. While more than 20 percent of high school students in the U.S. drop out, only 6 percent of Japanese students do not complete high school. West Germany also emphasizes the education and training of its non-college bound youth. Publicly sponsored apprenticeship programs provide students with practical experiences that ease the transition between school and work (for a discussion of these points see Carnevale, 1991; Commission on the Skills of the American Workforce, 1990; Reich, 1991b; Reich, 1988; Thurow, 1991).

Much has been written on the need to improve the skills and competencies of the nation's workforce. The Hudson Institute's Workforce 2000 is the landmark study in this area (Johnstone, 1987). Since its publication in 1987, numerous reports have covered every aspect of workforce supply and demand: creating opportunities for disadvantaged workers (Jamieson, 1991; Hudson Institute, 1988), surveys of the skills employers need (Carnevale, 1988; U.S. Department of Labor, 1991; Commission on the Skills of the American Workforce, 1990; National Association of Manufacturers, 1991), international comparisons of workforce changes (Johnstone, W., 1991), and the roles of business and

⁴ American investors poured \$137 billion into foreign stocks in 1989, up 813 percent from the previous year; and, as mentioned earlier, American corporations increased their capital investment abroad by 13 percent in 1989 and by an estimated 17 percent in 1990 (Reich, 1991b).

industry, and educators in preparing for Workforce 2000 (U.S. Department of Labor, 1991; Allstate Forum, 1989 and 1990).

Most studies start with the assumptions of labor market change outlined in Workforce 2000. According to Workforce 2000, a labor shortage is emerging as a result of slow population and labor force growth. By the year 2000, the nation's labor force will have grown by about 22 percent since 1985, a slower rate of increase than during any 15-year period since the 1930s. Further, the disparity between the skills of workers and the skills required in the workforce is growing. First, more workers will be from low-skilled and "disadvantaged" populations by the year 2000. Non-Whites and Latinos, who have been underserved by the educational system, are expected to make up close to 29 percent of net additions to the workforce. At the same time, the majority of new jobs will demand more education and higher skill levels. Of the jobs created between 1984 and 2000, more than one-half will require some postsecondary training and nearly one-third will require a college degree (Johnstone, 1987).

Lawrence Mishel and Ruy Teixeira (1991) raise questions about this view of the near future. They argue that there is no direct correlation between slow labor force growth and a labor shortage. In fact, it is more logical to expect that slow labor force growth will lead to lower demand for goods and services, and thus slow growth in the demand for labor. They also question the validity of the "skills mismatch" theory. First, they contend, skill levels are not rising as fast as assumed in Workforce 2000. Second, although the composition of the labor force is changing, they do not expect the labor force to be as dominated by "low-skill minority and 'disadvantaged' workforce entrants" as other studies suggest. Conventional studies, they argue, underestimate the presence of White non-Latino males by focusing on net entrants (number of new entrants minus number of persons who left the workforce) rather than the total number of new entrants to the labor force.

These disputes are important, but most observers agree that more emphasis should be placed on improving the skills of America's workers. Even Mishel and Teixeira (1991) conclude skill levels are probably increasing too slowly given international competition. It is generally agreed that, if we are to compete in the new economy, we must improve the skills of **all** workers. Some states are reforming their educational systems by establishing minimum performance standards, and providing both college preparatory and school-to-work transition programs (for example, see Oregon Legislative Assembly, 1991).

Putting Research and Development to Work. In 1983, the Business-Higher Education Forum — a government advisory group made up of business and higher education leaders — recommended a number of changes to encourage technological innovation, including increased funding for company-sponsored research and development projects at universities, a 10 percent increase in federal funding for basic research, and strengthening technology transfer between government, business and industry, and higher education (Business-Higher Education Forum, 1983).

Others argue that investment in research and development should not only be increased, but redirected, putting more funds into improving production processes. American firms put two-thirds of their research and development money into developing new products and only one-third into improving production processes. Our major competitors, Japan and West Germany, invest the majority of their research and development money in improving production processes (Thurow, 1991; Carnevale, 1991).

Further, Robert Reich argues, government support of research and development should focus on activities that help Americans become technologically sophisticated, rather than on helping American firms make profits from new technologies. Subsidies to American companies for research and development frequently support technicians, engineers and production workers in overseas operations. Instead, Reich argues, subsidies should be made available to any company, regardless of the nationality of its ownership, that promises to undertake research, development, and production within the United States (Reich, 1991b).

III.

HIGHER EDUCATION AND THE NEW ECONOMY

What will the higher education institution of the future look like? Will students continue to learn in structured classroom settings, or will information technologies be used to reach out to students wherever they are? Will new reward structures encourage diverse and balanced faculties who excel in teaching, research (basic and applied), and service activities? Can higher education find ways to forge stronger links with business and industry, and with elementary and secondary education? These are just a few of the many challenges ahead.

Education for the 21st Century

Postsecondary education plays an important role in preparing people to live and work in the new economy and society of the 21st Century. Its effectiveness, however, depends upon its leaders' and practitioners' willingness and ability to adapt. The same forces that are increasing demands for postsecondary education and training are rendering obsolete the traditional methods of delivering educational services and challenging educators to re-examine the quality and appropriateness of the postsecondary curriculum.

Expanding Access. Projected declines in the number of traditional college-age youth in the 1980s led to predictions of declining enrollments. Contrary to these expectations, total enrollments increased steadily, close to 11 percent between 1977 and 1986 (Gerald, 1991). Two factors were behind this apparent anomaly. First, the college-going rates of the traditional college-going population (18-to-24-year-olds), women of all ages, and people of all racial/ethnic backgrounds increased dramatically. Second, decreases in the size of the traditional college-going population were offset by increases in college attendance by 25-to-34-year-olds, by non-Whites, and by Latinos (for a discussion see, Clotfelter, 1991).

As we near the 21st Century, colleges and universities will serve an increasingly diverse population. Working adults, many of whom are members of underrepresented populations, now make up a majority of college students. Although the size of the 25-to-34-year-old population that swelled higher education enrollments in the 1980s is declining, the working adult is likely to remain a significant consumer of postsecondary education. New technologies and the increasing demand for higher-order skills require a larger proportion of the current workforce to pursue training and retraining. Higher education is challenged to find new ways to prepare, recruit, retain, and graduate underrepresented students, to make education and training more accessible and convenient to working adults of all backgrounds, and to serve the needs of rural communities (Green, 1989; Perelman, 1984).

Serving Underrepresented Racial and Ethnic Populations. In the 1960s and early 1970s, significant gains were made in the postsecondary participation rates of underrepresented racial and ethnic groups. The number of non-White and Latino students increased from 150,000 in 1960 to approximately one million in 1975. The expansion of educational opportunities during this period can be attributed to a variety of

factors: increased attention to civil rights issues; legal efforts to eliminate discrimination; increases in student aid and other programs; expansion of the number of colleges and universities; active college recruitment of underrepresented students; and aid to historically black colleges (Green, 1989; Newman, 1985; Parnell, 1990).

Since 1975, however, progress has slowed. The enrollment of non-White and Latino students has increased, approximately 46 percent between 1978 and 1990 (U.S. Department of Education, 1992b), but this increase was the result of an increase in the non-White and Latino population, not in rates of participation. With the exception of some Asian-American populations these groups continue to be seriously underserved by the educational system. While Latinos made up 12 percent, African-Americans 15 percent, and American Indians/Alaskan Natives 0.9 percent of the 18-to-24-year-old population in 1990, they comprised only 6 percent, 9 percent, and 0.7 percent of enrollments in four-year institutions, respectively. In contrast, White non-Latinos made up 72 percent of the 18-to-24-year-old population, but accounted for 78 percent of enrollments in four-year institutions (WICHE, 1991a; U.S. Department of Education, 1992b).

In 1988, *One Third of A Nation* challenged American higher education to improve the recruitment, retention, and graduation of students from underrepresented racial and ethnic groups who will make up one-third of the nation's school-age children by the year 2000. One-third of new workforce entrants already are from these groups. Yet, at a time when economic competition places a premium on advanced skills and a high degree of adaptability, rates of minority participation in higher education remain disproportionately low (Commission on Minority Participation in Education and American Life, 1988). The importance of this issue is further attested to by the widespread discussion that has taken place in recent years (see for example, NEBHE, 1989b; WICHE, 1987, 1989 and 1991b; Green, 1989; Newman, 1985; Gilley, 1991; Parnell, 1990; Richardson, 1989 and 1990).

Many believe the problem is that most institutions take a piecemeal approach — grafting isolated, special programs onto the institution. According to a handbook on enhancing diversity, institutions that successfully attract and educate underrepresented students share one trait — “[t]hey have developed a comprehensive and institution-wide approach.” The report encourages institutions to develop a strategic plan which establishes the commitment of university leadership (top administrators, governing boards) and rank-and-file staff and faculty, clearly states the institution's goals, sets a timetable for meeting these goals, includes means for resolving conflicts, and develops a plan for measuring and evaluating success (Green, 1989; WICHE, 1991b).

Richard Richardson (1989) also urges institutions to go beyond traditional recruitment, outreach, and counseling efforts. He identifies three stages of institutional response. In stage one, institutions tend to react to the challenge by emphasizing recruitment, offering financial aid, waiving admission standards, and providing convenient course schedules. In stage two, institutions become more strategic, adopting interventionist strategies that help underrepresented students cope with institutional expectations — establishing special counseling and tutoring centers, opening minority student unions, developing

outreach programs to high schools, and scheduling multicultural social events. Stage three institutions realize that instead of changing the student to fit the institution, the institution must adapt. At this stage the institution makes a commitment to make faculty involvement and changes in academic practices (teaching methods, curriculum) an integral part of a strategic plan for diversity. There is general agreement that institutions must do more than develop new programs. When institutions make a commitment to quality and access all students benefit (Richardson, 1989; Green, 1989).

Increasing the postsecondary participation of underrepresented populations also requires aggressive federal and state action. Among the recommendations put forward are: revitalization of the TRIO programs (talent search, upward bound, education opportunity centers, and special services for disadvantaged students); formation of a National Opportunity Fund designed to support competitive grants to programs for disadvantaged students; state and business partnerships to stimulate the interest of non-White and Latino youth in higher education; expanding and strengthening federal and state need-based financial aid programs; mandating early identification programs at all colleges and universities; and developing a national urban extension program to revitalize urban areas (Gilley, 1991; Parnell, 1990; Newman, 1985; Richardson, 1990).

Serving Working Adults and Lifelong Learners. Similar recommendations have surfaced regarding the need to adapt the educational process to meet the needs of the changing economy. According to Lewis Perelman, 80 percent of the people who will make up the workforce at the turn of the century are already working. Of these, about one-fifth are classified as functionally illiterate and all are in danger of being displaced at some time during their work-life. Postsecondary education and training must, therefore, be available to workers throughout their life (Perelman, 1984).

The older, working student approaches postsecondary study differently. According to a study conducted by The College Board in the late 1980s, most mature students study part-time, work at least part-time, are married and/or have family responsibilities, return to school for career related reasons, prefer to attend courses in the early morning or evening, and attend institutions that are convenient to home or work (Aslanian, 1988). Although undergraduates over age 25 are more likely to work, and work more hours than younger students, students of all ages are more likely to hold jobs today. According to a Carnegie Foundation survey conducted in the mid-1980s, 39 percent of undergraduates work part-time and nearly one-quarter (23.5 percent) work full-time (McCartan, 1988). The new majority student must balance school, work, and often family responsibilities. Constraints on their time prohibit them from relocating or traveling great distances to pursue educational opportunities.

Serving Rural Populations. Human resource development, Daryl Hobbs observes, is a key factor in promoting and maintaining the economic and social health of rural communities. Small rural schools often are unable to provide the full breadth of courses available in larger urban schools. Consequently, students graduating from these schools are not as academically prepared for higher education and for the job market (Hobbs, 1989). Further, service industries have a larger role in the rural economy now than

agriculture and manufacturing, and information-based activities account for most of the growth in the service industry. Rural economies which once thrived because they possessed timber, crops, or minerals increasingly depend on "specialized human services, information processing and telecommunications" (Parker, et al., 1989). Declines in resource-based industries have led to widespread displacement of rural workers, who are in need of career counseling and job training. At the same time, farmers are finding they require a higher degree of business and technical training than they may currently possess if they are to compete in the global economy (Hobbs, 1989).

Postsecondary institutions have an important role in helping rural areas meet these needs. Although acquiring increased skill levels often leads to out-migration, increased levels of education enable rural workers to be more flexible and adapt more easily to the demands of the changing economy. Rural communities need vocational-technical programs that target current skill and workforce needs; local access to continuing education programs for teachers and other professionals; and supplemental instructional programming for elementary and secondary schools.

Using Technology to Improve Educational Delivery. Whether in urban or rural settings, American business and industry must find new ways to constantly increase and reinforce the skills of their employees. The enormous complexity of modern technology and the speed at which new innovations arise makes career-long training a necessity (Baldwin, 1991; see also Reich, 1991b; Commission on the Skills of the American Workforce, 1990). The inflexibility of the traditional university schedule often presents a hardship for this clientele, and institutions of postsecondary education have had to find new ways to deliver courses to them (Hall, 1991; Carey, 1991). The use of new technologies (telecommunications and computers) plays an important role in higher education's overall strategy for meeting the needs of rural communities, and the life-long learning needs of the workforce.

The idea of the 'distributive university' provides one model for adapting higher education to the changing economy and society. In the 'distributive university' numerous institutes or campuses throughout a given geographical area are linked by telecommunications. Each facility has access to the resources and activities of all other facilities on the network. A student at one campus can take courses at a distant site via satellite downlinks, order books through a library network, and communicate with faculty from home via personal computer. The 'distributive university' is designed to facilitate the life-long learning process. According to Wade Gilley, this concept is taking hold in fast growing areas such as the Washington, DC/Northern Virginia area served by George Mason University, and also holds potential for university systems that serve large, sparsely populated areas, such as the University of Alaska (Gilley, 1991).

While the model of the "distributive university" is compelling, it is not likely to be widely adopted for many years. Nevertheless, the introduction of information technologies into the life of the contemporary university is already having an impact. Computer technology makes possible the rapid processing of large amounts of information, and puts it at the personal disposal of even the least technically sophisticated faculty and students. With

telecommunication technologies (facsimile machines, modems) information can flow rapidly across international borders, opening up new avenues for faculty collaboration, access to information resources, and student interaction with other cultures. Institutions of higher education are finding it necessary and beneficial to incorporate information technologies into the administrative and academic life of the campus — from telecommunications and computer aided-learning to computerized registration systems and on-line library catalogs.

Distance Learning. Distance learning enables businesses to provide specialized training to their employees on a regular basis at multiple sites, while minimizing the amount of time employees must take away from their job to pursue education. The National Technological University (NTU) is one example of a collaborative effort between higher education and industry through which engineers can take advantage of continuing education and advanced degree programs without leaving the worksite. NTU represents the cooperative efforts of 35 major engineering colleges to deliver high quality instructional programming for the engineer, technical professional, and manager. The campuses are linked by satellite to 325 locations nationwide, serving more than 113 organizations, including corporations such as ALCOA, Whirlpool, Xerox, and the U.S. Army Corps of Engineers (Baldwin, 1991; Hall, 1991).

According to the Western Cooperative for Educational Telecommunications (WCET), every state in the West has invested to some degree in educational telecommunications services. Some states, such as Hawaii and Utah, have highly developed state systems of telecommunications designed to deliver educational services to communities throughout the state. Others, like South Dakota, have one or more operating telecommunications systems, with minimal state coordination. Educational telecommunications is growing rapidly and will continue to grow in all of the western states (Dively and McGill, 1991).

Technology and Instruction. The potential uses of information technologies in education are not limited to distance learning. The computer's ability to manipulate words, numbers and graphic images and connect information based on the way ideas are related to each other makes it a valuable instructional tool. Examples of innovative instructional programs using computer technology abound. Science experiments that are too dangerous or expensive to conduct in undergraduate laboratories may be conducted through computer simulations. Computer simulations also enable students to practice applying knowledge to real-world situations — from making ethical decisions on medical cases to handling an actual law case from beginning to end. Moreover, using process and collaborative approaches to teaching composition — in which students share successive drafts of their work with fellow students and teachers or write reports as a team — becomes more feasible when computers are introduced. Instructional programs using computers foster and encourage critical thinking by enabling students to query for information, make logical connections, and trace "webs" of influence in literature, history and other disciplines (Kozma and Johnston, 1991).

The use of information technologies has a profound impact on the way we learn. In the classroom, new technologies change the relationship between teacher and student.

Telecommunicated discussions and computer simulations put everyone on a more equal footing regardless of assertiveness, or physical, regional, and cultural differences (Johnstone, S., 1991). Moreover, computer simulations and dialogues enable students to engage in dynamic problem-solving exercises. Learning becomes a process of understanding and application rather than memorization, transforming students from passive receptors of knowledge to active participants in the learning process. In this situation, the instructor becomes a mentor or facilitator rather than a purveyor of knowledge. For the instructor this means a greater commitment to course preparation and to learning new ways of interacting with students as active learners (Kozma and Johnston, 1991; Johnstone, S., 1991).

Telecommunications has expanded the university community. Faculty and students not only can engage in on-going discourse with their colleagues at other colleges and universities in the United States, but also can connect with colleagues throughout the world. Used to its full potential, this technology can provide undergraduates with a truly global perspective. Telecommunications projects in elementary and secondary schools already bring the larger world closer for the nation's youth. In 1989, eighth graders in Massachusetts participated, with students from West Germany, in a teleconference on nuclear power, toxic waste, and other global issues. Students in the Delaware Telearning Project go on "electronic field trips," speaking with experts as far away as Australia and South Africa (OTA, 1989). The possibilities for incorporating similar programs into the undergraduate curriculum are almost limitless.

If the full potential of these technologies is to be realized, however, many issues remain to be resolved. First, while there are many excellent examples of innovative instructional programming, computers and telecommunications are not being used to their full potential in the classroom. According to Robert Kozma and Jerome Johnston (1991), of the more than 200 submissions received each year for the EDUCOM/NCRIPTAL Higher Education Software Awards, only 30 involve innovative instructional programs. While higher education institutions have invested heavily in telecommunications equipment and computers, many complain the teaching process has not changed to take advantage of these technologies, and only a small proportion of faculty use technology in instruction (Carey, 1991; Kozma and Johnston, 1991).

Although faculty involvement is crucial to the successful incorporation of technologies in the curriculum, faculty frequently are discouraged from adopting innovative instructional approaches because of the time and energy required. Using new technologies requires a high level of attention to technical details (software, hardware, etc.) even after a project has been operating for a number of years. Moreover, technology is not a substitute for good teaching. A great deal of time must be devoted to designing and redesigning instructional programs and the course materials that accompany them (Kozma and Johnston, 1991; Hall, 1991). The faculty who take on these projects frequently do so in spite of institutional norms that discourage giving this kind of attention to teaching. Faculty frequently cite a lack of release time, money, equipment, and technical assistance as reasons for not incorporating instructional technology into the curriculum (Kozma and Johnston, 1991). Similar observations have led James Hall to conclude that "...a

conceptual design for an electronic university proves easier to talk about than to implement" (Hall, 1991: 107).

Other questions remain to be answered regarding the effectiveness of computer-aided learning modules and telecommunications in instructional programs. The research that suggests students learn as well or better in this environment is based on evaluations of distance learning programs that work exclusively with academically advanced and highly motivated students. It is not clear from the available research whether these technologies succeed as well with "at-risk" or less motivated students. Moreover, while students give their telecommunicated courses high marks, the majority say they prefer to take classes where they meet face-to-face with the instructor and other students. The growing interactivity of the medium may shift these preferences somewhat, but telecommunications will never replace the need for personal interaction between faculty and students (Johnstone, S., 1991). Further, an adequate body of research does not exist on the effectiveness of computer-aided learning programs. According to Kozma and Johnston (1991), very few of the EDUCOM/NCRIPTAL innovative computer-based learning programs include an assessment plan, since there are barely enough resources to support program development, and most faculty involved in these programs are not trained in assessment methodologies.

Technology and the Library. Telecommunications and computer technologies are rapidly transforming the university library and scholarly publishing. Computerized cataloging systems are quickly becoming the norm in university libraries. The potential exists for users to have access to library catalogs worldwide. Networks such as CARL (The Colorado Alliance Research Library) and MELVYL (the union catalog of the University of California system), link multiple libraries together. Users can access these systems in their home libraries or over networks. Network users on the Internet system can access more than 100 library catalogs and other resources. Searches through indexes and large databases that once required the assistance of trained library staff, can now be accessed directly by faculty and students on CD-ROM computer systems (Lyman, 1991).

Digital technology makes it possible to store entire texts on a computer network until they are retrieved by the user. In the future, books will be only one small part of the library's holdings. More and more reference materials (e.g., census data, government publications, etc.) are being made available on CD-ROM systems and over networks. Textual databases, such as the Medieval and Early Modern Data Bank and the Thesaurus Linguae Graecae, make specialized materials available to scholars and students on-line. At Carnegie-Mellon University, faculty and students can retrieve documents stored on computers across the nation without leaving their home or office. Moreover, the distinctions among the publisher, the library, and the bookstore are becoming blurred. McGraw-Hill has a program which enables faculty to customize course material from McGraw-Hill publications, which are printed on-demand and sold at campus stores. Further, through the use of electronic mail, faculty are able to engage in collaborations and extended discussions with colleagues throughout the world. Electronic journals are popping up which are refereed and obtained by subscribers on-line. Digital technologies

enable scholars to immediately access the most timely information available, without waiting for the publishing cycle (Lyman, 1991).

Some cautions apply to the way in which these technologies are impacting the library. Networks and CD-Rom technologies have, without question, made the library more efficient. However, the culture and lifestyle of the university is resistant to dramatic change. Faculty and students prefer to browse through books on the stacks. The prestige of institutions is still determined, in part, by the size of their library collections. Most institutions are not yet willing to give faculty credit in promotion and tenure decisions for work presented in electronic journals. Moreover, widespread access to texts and data in digital form raises legal and ethical issues. How will privacy, free speech, and the security of the system be balanced? What principles should guide collection and access? What are the rights and duties of users of electronic publications? Finally, it is not clear what impact these new technologies will have on the quality of information and the process by which scholars use and create new knowledge. "Each medium," Peter Lyman stresses, "offers a unique spectrum of communication." An instruction manual is ideally suited for a hypertext (computer query) environment, in ways that a philosophy text or a work of great literature is not (Lyman, 1991).

Ensuring the Effective Use of Technology. Institutions play an important role in creating an environment which encourages the integration of administrative and academic telecommunications and computer systems and the development of innovative instructional approaches. In defining common goals and coordinating support services, institutions can minimize costs and make the benefits of technology available to the entire campus community.

In the college of the 1990s, Brian Hawkins argues, computer support services must be integrated into the instructional mission of the institution. Institutions are well advised to provide faculty with access to a well-organized technological support staff that can help them master technologies, overcome technical problems, and design innovative curriculum. A critical mass of technological and academic support staff is needed, and the director of computer services must be both technically knowledgeable and possess a thorough understanding of instruction and the academic environment (Kozma and Johnston, 1991; Hawkins, 1991).

An effective plan for integrating new technologies also must include a long-range strategy for financing technological infrastructure (fiber optic lines, computers and other equipment). While the life cycle of physical infrastructure is measured in decades, the life cycle of computers and other information technologies is measured in years. The initial purchase of capital equipment represents only one-half the cost of operating educational technology systems. The other half is consumed in maintenance, support, and system upgrades. Yet institutions frequently invest in computer and telecommunications equipment with one-time funds, while failing to adopt comprehensive, long-range plans for acquiring and retiring technology. According to Brian Hawkins, 50 percent of the nation's higher education institutions purchase equipment with one-time funds. Further, while 15 percent have formal plans for acquiring and retiring equipment, fewer than 1 percent had

comprehensive, fully funded programs in 1990 (Hawkins, 1991; Carey, 1991; Kozma and Johnston, 1991).

State coordinating and governing boards, and legislative and executive bodies, also play an important role in encouraging the effective use of educational technologies in higher education. The goal of educational networking is to expand services to the entire educational community. Developing an effective statewide telecommunications system requires that teams representing all levels of the educational system oversee planning and operation. State governing and coordinating boards can be leaders in these efforts, encouraging cooperative ventures among state universities, community colleges, and the K-12 system. Moreover, the state has a vested interest in economic development, but where educational technology is viewed primarily as a tool for economic development, there is a danger that states will favor services for businesses that are able to cover the full cost of instruction. States have an obligation to make sure that people who can benefit from the new instructional technologies, but who are less able to cover the full cost (such as teachers, social workers, and economically disadvantaged rural and urban populations), have adequate access to innovative instructional programs and equipment. Further, as technology becomes ubiquitous, the need to incorporate technology into instruction becomes all the more critical to ensuring the quality of education. The growing interest on the part of state higher education boards to assess the quality and outcomes of state educational offerings must extend to the assessment and evaluation of instructional technologies. Finally, technology has the potential for altering and expanding the roles and missions of institutions. Governing and coordinating boards may find it desirable to go so far as to eliminate geographical service areas as they relate to telecommunicated programs; and to consider diversity of instructional methods, as well as institutional types, when evaluating the mix of higher education services available in their state. As the use of these technologies expands, state higher education boards will find it increasingly beneficial to promote state and regional cooperation for sharing educational technologies, quality instructional programming, and other services within and among states (Jonsen and Johnstone, 1991; Dively, 1987).

Although states are the primary source of public higher education funding and an important source of funding for independent institutions, traditional methods of formula funding do not work well for funding instructional technologies. Formula budgets are generally based upon the relationship between costs and full-time equivalent enrollments or course credits. The operating costs of technological delivery systems, however, are not directly related to enrollments or course credits. According to Goldstein and Woolsey (1987) the high cost of maintaining and upgrading equipment, and differential costs related to the number and skill levels of personnel needed to operate these systems, distort traditional funding equations. Therefore, while educational technologies produce cost savings by educating large numbers of students, the cost of educating the first 10 students is likely to be much higher than in the traditional classroom. Acquiring sophisticated equipment through the state capital budget also presents problems because funds are severely restricted by available revenues and current state debt levels. Further, Goldstein and Woolsey (1987) argue, even when funds are available the slowness of the state budgeting process, and its inflexibility often result in the purchase of equipment

that is obsolete before it is installed. Finally, he contends, state controls on the acquisition of equipment (competitive bidding, mandatory review by central purchasing agencies, and restricting purchases to an approved list of vendors) can add costs to purchases and sometimes make it impossible for an institution to acquire the special equipment it needs. Further, institutions can defray some operating expenses by making technology-based programs available to business and industry, but state laws and private sector fears of unfair competition can limit their ability to make such arrangements. Another way for institutions to finance equipment is through long-term debt. While this can be a good solution, institutions must be careful that the cost of servicing the debt does not cut significantly into operating revenues for personnel and support services.

According to Fratkin (1991), the federal government has played a limited role in educational technology. While progress has been made in the development of supercomputing facilities, the interests of education, business, and government in the use of information technology have not been linked effectively. Most research and support for technology comes from the National Science Foundation and the defense establishment. The U.S. Department of Education has yet to articulate a technology agenda for higher education. Nevertheless, if the United States is to compete with Japan and Europe, Fratkin argues, we must develop a national technological infrastructure (fiber optic networks, etc.), much like the interstate highway system; and foster alliances among government, industry, and education.

Ultimately, the literature cautions us to remember that technology is not an end in itself, but a tool that can be used to improve communications, instruction, and administration. States and institutions are well advised to assess thoroughly state and regional educational needs before designing and acquiring educational technology. Adopting technologies without careful attention to the needs being served frequently leads to inefficiencies and systems that are inadequate to the tasks they are needed to perform. Dwight Dively advises states to assess their basic educational needs and carefully articulate major state goals such as access, educational quality, and economic development before designing high technology systems. Each type of educational technology should then be evaluated in light of its unique ability to meet these needs and help the state accomplish its goals (Dively, 1987).

Improving Undergraduate and Graduate Education. Workers today must possess a variety of skills and competencies. Most important among these are the ability to think creatively, and the possession of conceptual skills that enable them to compare and contrast ideas, and prioritize information. In a world in which industries come and go rapidly and people change careers four or five times in a lifetime the successful individual will be one who can think rather than simply remember (Sculley, 1988; Reich, 1991b, 1991a and 1988; Thurow, 1992; Commission on the Skills of the American Workforce, 1990; Carnevale, 1991; Carnevale, et al., 1988; U.S. Department of Labor, 1991).

During the past decade, there has been an on-going discussion about the ability of our nation's institutions of higher education to prepare students for the workforce and society of the 21st Century. Although most agree that the American system of higher education

is among the best in the world, change is needed if American higher education is to continue to provide a quality educational experience (Boyer, 1987; Gilley, 1991; Newman, 1985; National Commission on Excellence in Education, 1983). Postsecondary education has become too specialized, contends John Sculley, President of Apple Computer. Most people coming out of higher education today lack creativity, have weak communication skills, and a limited view of the world (Sculley, 1988). How can higher education teach students to be flexible and give them the skills they will need to adapt to a constantly changing economy? What role should higher education play in preparing students to live in an international, intercultural world, and multicultural society? Can and should curriculum and teaching methods be changed to teach critical thinking and other higher order thinking skills?

Balancing liberal and professional education. Have undergraduate and graduate education become too specialized? Indeed, the trend in higher education during the past two decades has been toward professionalization. In 1970 most students chose majors in the arts and humanities. By 1985 the percentage choosing those majors had declined by one-half. In contrast, business majors increased from 16 percent to 27 percent, making business the single most popular major (Boyer, 1987: 104; see also Woditsch, et al., 1987; Breneman, 1990). Moreover, demands for professional credentialing encourage small liberal arts colleges to shift away from their original missions. According to David Breneman (1990), many liberal arts colleges are surviving by becoming small professional colleges.

It is the study of liberal arts, however, that provides people with strong conceptual skills, creative outlets, and the knowledge they will need to function in the international and intercultural world in which we now live. Through liberal education students become more aware of themselves, their values, and their relation to others; more other-centered; more capable of thinking relationally and working with others cooperatively; develop a stronger sense of self and become more autonomous (Brandt, 1989; Gardner, 1984; Boyer, 1987). Several studies also suggest persons trained in the liberal arts are superior to business and engineering majors in administrative skills (organizing, planning, decision making, and creativity) and interpersonal relations (leadership, oral communication, and personal impact) (Woditsch, et al., 1987).

Nevertheless, professional and technical training is important. As Ernest Boyer (1987: 109) points out, "...all students, regardless of major, are preparing for productive work." Successful graduates must possess technical expertise and be encouraged to discover the social and political significance of work. Work in the new economy demands a balance between liberal arts education and career preparation at all levels of education (associate, baccalaureate, and graduate). Rounding out technical training, graduate education in applied fields and professional education with liberal arts training, among other things, promotes conceptual skills, creativity, and knowledge of other cultures (Boyer, 1987; Parnell, 1990; Study Group on the Conditions of Excellence in American Higher Education, 1984).

Strengthening General Education. The only way to provide an integrated approach to learning, many argue, is by restructuring curriculum and teaching methods. Providing students with what they need to be successful in today's world will require more than simply giving students a wider range of course choices. Some argue that colleges have abdicated their academic authority and become little more than "self-serve cafeterias," and that institutions must reassume the responsibility of establishing a strong core curriculum (see for example, Boyer, 1987; Gardner, 1984; Gambino, 1990; Bloom, 1987; Schneider, 1991; Smith, 1981). This core curriculum must help students discover the connections among subjects and disciplines; and between the humanities and technology in particular (Boyer, 1987; Gardner, 1984; Verkuil, 1986; Truxal, 1986).

Boyer proposes the adoption of an "integrated core" curriculum. In this view, general education is not a set of courses, it is an overarching educational philosophy. The entire undergraduate experience, from freshman year through graduation, is designed to provide students not only with essential knowledge but also with connections among disciplines and with the ability to apply knowledge to life outside the university. Such a course of study is inherently interdisciplinary, challenging students and faculty to cross disciplinary boundaries and place knowledge in perspective. In this type of undergraduate program professional/technical and liberal arts education are intertwined (Boyer, 1987).

Discussions of the core curriculum inevitably turn to substantive matters. What should be taught and how? Should and can diverse cultural perspectives be infused into courses without promoting relativism or watering down the curriculum? How can educators ensure that students study foreign languages and broaden their understanding of other countries?

Multiculturalism. There is little doubt that we live and work in a multicultural society. The U.S. Bureau of the Census estimates that by the middle of the 21st Century no single racial or ethnic group will be in the majority (U.S. Bureau of the Census, 1986). Minority-majority populations already exist in some areas of the country (New Mexico, the District of Columbia) and on some college campuses (University of California, Berkeley), and one-third of new workforce entrants already are members of underrepresented racial and ethnic groups (U.S. Bureau of the Census, 1990; U.S. Department of Education, 1990a; Johnstone, 1987).

As the participation of women and members of underrepresented racial and ethnic populations in postsecondary education and the workforce has increased, so has the pressure to incorporate diverse cultural and gender perspectives into the curriculum. Issues of race and ethnicity frequently elicit highly charged, emotional responses which cannot always be anticipated or easily diffused. Requiring students to acquire an understanding of other cultures within the curriculum is one way institutions attempt to minimize incidents of harassment and racism on campus and prepare students for life in a multicultural society (Green, 1989; Richardson, 1989). Typically, institutions have responded by adding separate ethnic and gender studies programs. However, since these courses usually are one of many choices for fulfilling a general education requirement, most students never benefit from them (Schneider, 1991; Green, 1989).

In short, promoting multiculturalism means more than sponsoring cultural events that are attended by a minority of the campus community, or offering a few "culturally related" courses. It requires, among other things, infusing multicultural perspectives throughout the curriculum by rewarding faculty for making these changes and providing faculty with professional development opportunities that enrich their understanding of multiculturalism (Ross, 1989; Green, 1989; Richardson, 1989).

Attempts to integrate multicultural perspectives into college curricula, however, have met with stiff opposition from some segments of the academic community. Opponents of multiculturalism portray themselves as the guardians of the western heritage. This position, made popular by Allan Bloom, equates true liberal learning with a thorough exploration of the "Great Books," accepted into the "canon" because their message is considered to have universal significance to humanity. Through the study of these texts, it is claimed, students are taught to "seek the truth" about the human condition. Introducing the concerns of "special" groups (racial, ethnic, and gender studies) is seen as diluting the curriculum by turning students away from the pursuit of truth and promoting a mindless "openness" (Bloom, 1987). The other side of the debate is usually portrayed as hostile to the legacy of western scholarship, and determined to subvert the curriculum by removing the works of "dead white scholars" and replacing them with works by non-western authors. Few campus discussions, however, are as stark and unrelenting as this portrayal.

The popular presentation of the debate between "the western tradition" and multiculturalism does not accurately reflect the thoughtful discussion that often occurs. Indeed, according to a report from the American Association of Colleges, there is "an emerging renaissance of curricular dialogue and invention" on the nation's campuses (Schneider, 1991: 3). Although the content of general education requirements is diverse in the 63 institutions involved in the American Association of Colleges' "Engaging Cultural Literacy" program, there are several common themes. First, institutions are careful not to promote "easy relativism." Rather, they are broadening syllabi to include multiple contributions to western and world culture and challenging students to develop their capacities for interpretation, analysis, and judgment by directly engaging them in the realities of our diverse world. Second, institutions are committed to using a "rich and complex" array of primary texts. Unlike the earlier "Great Books" movement, however, these texts are not taught as ends in themselves, as arguments among "great thinkers," or as ways of determining universal philosophical or aesthetic standards. Rather, texts are used to explore cultural topics. Students are taught to both "read" the text for its strategy, structure, and content, and also view it as a reflection of another way of life. Ancient texts are used to help students understand issues and themes within the context of modern culture. By asking students to critically examine their own culture, they are given a "personal stake in the humanities" (Schneider, 1991).

But infusing multiculturalism into the curriculum alone will not eliminate conflict or teach students how to live in a multicultural society. Support for multiculturalism from institutional leadership is critical to the success of diversity. Campus leaders have an obligation to send a message to the campus community about behaviors that are not

appropriate, to establish mechanisms for resolving conflicts, and promote an environment in which multiculturalism is viewed as an institutional strength (Richardson, 1989; Green, 1989; WICHE, 1991b).

Internationalism. Narrow parochialism is a severe handicap in the emerging global economy. Yet the evidence suggests that Americans are poorly equipped to participate in the global society of the late 20th Century. Of the approximately 1,000 American businessmen in Japan in the mid-1980s, only a few understood Japanese. In contrast, all of the approximately 100,000 Japanese businessmen in the United States speak English. Moreover, only three of the American hostages in Iran spoke Farsi; no American foreign service officer in Afghanistan understood Russian when the U.S.S.R. invaded that country; and of the two American scholars who had significant knowledge about Angola during the Angolan crisis, neither spoke Angolan. Economic Development and Trade Association leaders cite this lack of international expertise as a major obstacle to economic competitiveness (Pyle, 1984; Business-Higher Education Forum, 1986; NEBHE, 1989a; Task Force on International Education, 1989).

Just as the need for people with international and intercultural expertise is increasing, our commitment to global education has weakened. Few students have an adequate understanding of other cultures, world geography, and international events (Barrows, et al., 1981; Gallup, 1988). Interest in language acquisition has decreased. Only one-fifth of high school graduates had at least some language skills in 1987, compared with more than one-third before World War II. Only 16 percent of American colleges and universities required foreign language for admissions in 1988, compared to 34 percent in 1966. A recent analysis of undergraduate transcripts revealed that more than one-half of baccalaureate degree recipients took no foreign language instruction. The Fulbright program, the most comprehensive effort to provide American scholars with international expertise and experience, was cut more than 60 percent in the 1980s (Pyle, 1984; Newman, 1985; Business-Higher Education Forum, 1986; NEBHE, 1989a; Task Force on International Education, 1989; Lambert, 1989).

We must prepare students to live and work in the global economy and society. Universities can do this by expanding study-abroad programs, rethinking foreign language requirements and programs, integrating international studies courses and concentrations into the core curriculum, cultivating international faculty exchanges, and increasing the presence of international students on American campuses.

Study-abroad programs, as they are currently organized, are inadequate to the task. Fewer than 1 percent of American undergraduates take advantage of these programs. Most study abroad for only a semester or summer session. Only 16 percent of those studying abroad spent a full academic year abroad during the 1989-1990 school year. Humanities and language majors make up the majority of students in these programs, while students in business and professional programs are seriously underrepresented (IIE, 1991; Boyer, 1987). Further, the students that participate in study-abroad programs are more likely to be from selective liberal arts institutions. Students from less selective

institutions and lower-income backgrounds rarely participate, due in no small part to a lack of financial support (Newman, 1985; Boyer, 1987).

Since most American college students never have the opportunity to study abroad, their exposure to international education usually is limited to a few internationally oriented courses. Yet discussions of the need for expanding international and intercultural education tend to focus on exchange programs while ignoring the rest of the curriculum (see for example Newman, 1985; Pyle, 1984). As early as 1975, the American Association of State Colleges and Universities urged its member institutions to explore, among other things, ways of making international and intercultural education an integral part of a quality education (AASCU, 1975).

Today, the majority of institutions include international studies in their general education requirement. Nevertheless, because these courses often compete with a wide range of courses that fulfill a distribution requirement or are grouped with studies of domestic cultures as part of an intercultural education requirement, students can complete their undergraduate education with only minimal exposure to international studies. Moreover, since most international studies courses are narrow in focus (e.g., French literature, British politics), students tend to learn a lot about one country or culture while remaining ignorant of the rest of the world. Some institutions do encourage students to take western civilization, or world civilization courses. While these courses provide a broader approach to international studies, they tend to be historical in nature and to take the "Great Books" approach. Civilization courses seldom teach students to interpret and analyze contemporary international issues, or expose them to non-western cultures (Lambert, 1989).

Exposure to foreign languages also is limited. Although interest in learning a foreign language increased by 4 percent between 1983 and 1986, only a minority of students enroll in foreign language-related courses, and most of those are humanities or social science majors. Students in applied and professional fields are much less likely to study a foreign language. Moreover, it is not clear that students who enroll in foreign language-related courses are achieving the broad cultural understanding they need. More than 60 percent of foreign language-related courses at research and comprehensive institutions, and 85 percent at two-year institutions focus on skill acquisition. Only at liberal arts colleges, where literature is the principal vehicle for foreign language instruction, are the majority of courses not skill related (Lambert, 1989).

How can institutions make international and intercultural education a larger part of the student experience? If we want students to develop a "global understanding," Richard Lambert (1989) suggests, including international education in general education requirements may not be sufficient. Instead, institutions may have to integrate international content into the courses that most students take (in the humanities, social sciences, and applied fields). Moreover, where undergraduate international studies majors exist, they should tend more toward a broad liberal arts approach, rather than narrow specialist training. The disparate career patterns followed by undergraduates do not warrant over-specialization. Finally, to strengthen the value of foreign language,

institutions should expand the number of substantive courses in which foreign languages are used, find ways of providing students courses in non-western languages, and develop new curricular materials and teaching strategies that give students a broader cultural understanding.

Richard Lambert (1989) also suggests that American colleges and universities dramatically increase the overall scale of study-abroad programs, increase the participation of underrepresented groups (students majoring in applied and professional fields, members of underrepresented racial and ethnic groups, community college students, and working students) in particular, and support longer stays in foreign countries for more students. A special effort also must be made to establish more extensive study-abroad programs in non-European countries and provide students adequate preparation by offering the appropriate area studies and language courses. Other options, such as placing students in English-mediated American enclaves, are inadequate. Moreover, the study-abroad and home campus curricula should reinforce each other. Unless this occurs, students and faculty will continue to see study-abroad as a "diversionary frill," rather than a central part of the educational experience. Ultimately, Lambert argues, study-abroad should be viewed as a national program, in which coordination and integration of the various types of study-abroad programs prevents duplication and fills in gaps.

The international perspective on campus also can be augmented by more effective faculty exchanges and foreign student involvement. Fulbright and other faculty exchange programs should be strengthened, and exchanges with non-western nations encouraged (Newman, 1985). While American higher education institutions continue to be popular with students across the world, competition for international students is increasing. If American institutions are to be competitive in the future, they will need to pay more attention to the academic and personal needs of these students, by providing courses for those who are not proficient in the English language and support services to help foreign students successfully deal with the registration process, find appropriate housing, and deal with immigration authorities. Unfortunately, few institutions even have specific policies for dealing with international exchange (Kaplan, 1987).

In recent years, American institutions of higher education have begun opening extension centers outside the United States. While the goal of opening borders and providing international education is laudable, international university programs frequently are designed as for-profit ventures (collecting tuition from students in the host country), seldom promote the international education of American students, and are of inconsistent quality. The role of American students in international university extension centers needs to be expanded. Further, poorly designed educational programs that do not take into account the language abilities and educational needs of students in the host country may severely damage the overall reputation of American higher education outside the United States. States, governing and coordinating boards, and federal agencies should develop means for monitoring and evaluating these programs (Chambers and Cummings, 1990).

A recent federal initiative may provide solutions to some of these concerns. The National Security Education Act of 1991 passed both houses of Congress and was signed into law by the President in December 1991. This act provides scholarships for undergraduates to study abroad, curriculum grants to colleges and universities for programs in international and area studies and foreign languages, and fellowships for graduate students in those fields. It will triple the amount of federal funds currently being spent on undergraduate study abroad and, through fellowships to graduate students, will help to increase the number of faculty members specializing in foreign languages and international and area studies (Desruisseaux, 1991).

Creating An Active Learning Environment. In the highly competitive economy of the late 20th century business and industry must be willing to take risks and view change as an opportunity. We are at the point in our history where as many individuals as possible — not just a few — must possess the values and skills of the entrepreneur. Higher education can help achieve this end by developing individuals who are willing to take risks, be creative, and believe in the value of civic involvement (Newman, 1985).

The undergraduate experience, however, often inhibits creativity, risk taking, and civic involvement. In most college courses a professor stands in front of the class for 30 to 40 minutes laying out what the students should know. Students take notes and regurgitate the facts they have memorized on the next examination (Boyer, 1987; Newman, 1985). A Carnegie Foundation survey of faculty and students found that neither students nor faculty were satisfied with the current learning environment. Faculty were critical of students' lack of interest in 'learning,' their desire to be 'spoon-fed' information, and their tendency to value good grades over good education. Students, on the other hand, felt that many faculty members were not engaged in teaching. They frequently perceived faculty as lacking human qualities, more interested in research than teaching, and isolated from their students' concerns (Boyer, 1987; see also Cheney, 1990).

Going beyond traditional teaching methods and involving students in learning requires a different attitude from faculty, students, and administrators. Boyer, quoting Carl Schorske of Princeton, emphasizes that 'learning' regarded as a noun "...is a thing to be possessed and passed along." Teachers who view learning in this way believe it is their job to present a pre-packaged set of information to students. If 'learning' is viewed as a verb, however, a totally different teaching style must be adopted (Boyer 1987: 151).

Indeed, most of the literature on learning emphasizes the importance of actively engaging students in the learning process, and many examples of effective interactive teaching strategies are available. For instance, a faculty member who effectively utilizes interactive teaching strategies might break large classes into small groups for discussion; transform lectures into dialogues; require in-class presentations and debates; develop simulations or give demonstrations; link subject matter to students' outside activities; provide thorough and constructive comments on assignments; and involve undergraduate and graduate students in research (Boyer, 1987; Newman, 1985; Task Group on General Education, 1988; Study Group on the Conditions of Excellence in American Higher Education, 1984; Faculty Teaching Excellence Program, 1988; Lenth, et al., 1989; Cheney,

1990). Another way of encouraging student involvement is through collaborative course development, in which committees of faculty, students, and administrators work together to design course syllabi and discuss teaching methods (Task Group on General Education, 1988; Newman, 1985). Using undergraduates as teaching assistants or peer tutors is another way of involving them in the learning process. In order to help others understand subject matter, these students must explore topics analytically and in greater depth (Task Group on General Education, 1988).

For their part, institutions should provide an atmosphere conducive to active learning. Class sizes of 200 to 500 are common at research universities. The sheer size of these classes limits student-faculty interaction, and the freshmen and sophomores in these classes seldom have access to the most experienced teaching faculty. It has been suggested that institutions reallocate resources toward serving first- and second-year undergraduates, exposing them to the finest teaching faculty and classes small enough to permit meaningful student-faculty interaction early in their academic career (Boyer, 1987; Study Group on the Conditions of Excellence in American Higher Education, 1984).

In addition, if faculty are to become better teachers, institutions must provide adequate professional development opportunities. Traditionally, faculty have learned to teach by doing. As graduate teaching assistants they were sent into a classroom with a syllabus and a text, and told to teach, with limited supervision by senior faculty. At some institutions these practices are changing. Graduate assistants are required to take seminars on teaching methods, prepare syllabi, lecture, and lead discussions. Experienced teaching faculty evaluate the teaching of graduate assistants and act as mentors. In some cases these programs are designed as apprenticeships, with graduate assistants training and student teaching directly under the supervision of qualified teaching faculty. Faculty members also are being given the opportunity to examine their teaching methods and learn new strategies (Boyer, 1987; Newman, 1985; Wegner, 1990).

Moreover, a student often learns valuable lessons outside the classroom. Through work and extracurricular activities students strengthen their leadership and interpersonal skills and develop an active sense of the value of civic involvement. Institutions should expand opportunities for students to engage in internships, volunteer civic activities, intramural sports, cooperative education, and other extracurricular programs (Newman, 1985; Study Group on the Conditions of Excellence in American Higher Education, 1984).

Improving the Status of Teaching in the Profession. Higher education critics frequently blame faculty for a decline in the quality of undergraduate education (Select Committee on Children, Youth, and Families, 1992). Faculty, they argue, view teaching as a necessary evil that takes time away from the work they consider truly important — their research — and the result is less attention to teaching responsibilities.

This characterization grossly oversimplifies the actual situation. Teaching is very important to the vast majority of faculty. A recent Carnegie Foundation survey of faculty found that 70 percent of all faculty say their interests lie more in teaching than in research. This was true for more than one-third of faculty at research universities, and

93 percent of faculty at two-year institutions (Carnegie, 1989). Another recent faculty survey found that, on the average, full-time faculty spend more than one-half of their time on teaching, with the remainder split equally among research, administration, and service. Even faculty at research universities say they spend 39 to 47 percent of their time on teaching activities (U.S. Department of Education, 1990b). Moreover, most faculty express a genuine love for teaching and mentoring undergraduates (Clark, 1987).

Although they may enjoy working with undergraduates, faculty learn early in their careers that quality teaching does not lead to professional recognition or success. Formal faculty promotion and tenure policies stress the importance of teaching, research, and service. In practice, however, faculty know that without an adequate number of publications to their credit they will not receive tenure, regardless of the quality of their teaching or their dedication to service. Fifty-four percent of the faculty responding to the 1989 Carnegie survey said it is difficult to receive tenure in their department without publishing, an increase from 49 percent two decades ago. Even faculty at comprehensive (65 percent) and liberal arts (39 percent) institutions, where undergraduate education is the primary mission, say it is difficult to achieve tenure without publications. Moreover, the majority of faculty at research and doctoral-granting institutions, and more than 40 percent of faculty at comprehensive colleges, believe "the pressure to publish reduces the quality of teaching" at their institution. Even 14 percent of those at two-year institutions agree with this statement (Carnegie, 1989).

Since the Second World War, academe has become increasingly hierarchical. The more involved a faculty member or institution is with basic research activities, the greater their prestige. Faculty, administrators, the government, business, and the public are responsible for encouraging this trend. In the 1940s the federal government turned to university researchers for help with the war effort. Since then federal funding for basic research (from the National Science Foundation, Defense Department, National Institute of Health, National Institute of Mental Health, and Department of Education) has contributed significantly to university budgets (Boyer, 1987 and 1990). There is mounting evidence that universities are conducting more research under corporate sponsorship. Corporations make the investment because they reap benefits from the partnership (NSF, 1991). Further, although the public has been very vocal about the importance of teaching, when choosing a college, high school seniors and their parents tend to be more concerned about the prestige (synonymous with research reputation) of the institution, than with the quality of its teaching (Pew, 1990b).

Abandoning higher education's research mission is not the solution. Basic research has an important place in the academy. Contrary to popular belief, Robert Zemsky contends, research is "real work" (Zemsky, 1989). The basic research that takes place at the nation's colleges and universities contributes heavily to the wealth and vitality of government, society, and private industry (for example, see Boyer, 1990; Newman, 1985; Brett, et al., 1991; Epstein, 1991; and Powers, et al., 1988). Moreover, only faculty who are actively engaged in scholarly inquiry can impart a sense of excitement about intellectual discovery to students. Mary Patterson McPherson argues, that the pleasures derived from the search for and discovery of knowledge has a "recharging" effect on

faculty (McPherson and Schapiro, 1990; see also Clark, 1987; Woodbury, 1990; Rice, 1991). In fact, good scholarship can be a catalyst for good teaching. At research institutions, where good teaching is based on the love of a particular discipline, effective faculty "...view themselves as scholar-mentors whose goal is to help students apprehend and even generate knowledge and understanding" (Wagener, 1989). The mission of the comprehensive college, on the other hand, may be better served by engaging faculty in a "scholarship of teaching:" sharing ideas with their peers through lecture series, exhibitions, performances, service on faculty committees, and the development of curricular proposals. These activities, Ronald Woodbury contends, promote the intellectual vitality of faculty within the context of their teaching (Woodbury, 1990).

These sentiments are echoed in Ernest Boyer's recent recommendations for the academic enterprise. To move the discussion beyond the simple dichotomy of research versus teaching, Boyer calls for a definition of scholarship that is more responsive to the diversity of talents and needs found within the university. Scholarship, he argues, has four parts: discovery, integration, application, and teaching. The "scholarship of discovery" most closely resembles what is usually thought of as traditional research. According to Boyer, the pursuit of knowledge "enlivens faculty and invigorates higher learning." The "scholarship of integration" is closely related to discovery. It represents the careful and thorough effort to give new meaning to isolated facts and to make connections across disciplines. Through the "application" of new knowledge to human problems scholars actively engage in the interaction between theory and practice — simultaneously applying knowledge to problems and increasing their intellectual understandings. Likewise, the "scholarship of teaching" is a dynamic process. Scholars transmit, transform, and extend their knowledge through interaction with students. They also continue the "chain of knowledge" by passing on the love of inquiry to a new generation (Boyer, 1990; see also Rice, 1991).

Higher education needs a more inclusive view of scholarship, Boyer argues, one that recognizes and rewards the diversity of talent that exists within the professoriate. One way in which institutions of higher education can encourage this vision is by changing the faculty reward structure. Boyer recommends that colleges and universities develop "creativity contracts" in which faculty would lay out their goals for a three- to five-year period. Within the life of the contract, faculty could decide to shift from one scholarly focus to another, without fear of being penalized in promotion and tenure decisions (Boyer, 1990). Another option would offer faculty multiple professional tracks, each emphasizing teaching, research and public service to different degrees (University of Alaska, 1988). Regardless of the approach an institution takes, faculty should be expected to engage in activities that reinforce the diverse and distinct institutional role and mission. Ideally, most faculty will emphasize teaching, while focusing to varying degrees on basic research, the integration and application of knowledge, and public service (Boyer, 1990).

Boyer's ideas have given new life to institutional efforts to improve undergraduate education. Since the publication of *Scholarship Reconsidered* new avenues for scholarship have begun to emerge. In 1991 the Task Force on Faculty Rewards at the University of

California released a report strongly recommending that the review of faculty teaching be broadened and include peer reviews; that applied and interdisciplinary/integrative research be encouraged and rewarded; that faculty be rewarded for their achievements in helping the institution meet diversity and equity goals; and that faculty be given the flexibility to emphasize different aspects of scholarship at different points in their careers (University of California, 1991). This report was adopted by the University Senate in 1992. Other institutions also are actively pursuing new ways of defining scholarship. The University of Syracuse is in the process of adopting a faculty reward structure patterned after Boyer's recommendations. Efforts to improve the undergraduate experience at Syracuse already have led to significant changes in the way the university views the balance between research and teaching. Participants in this process foresee the day when the university community will accept a broadened definition of what constitutes scholarship; support tenure policies that reward strong teachers; and place more value on the quality, rather than the quantity, of research (Mooney, 1992).

Changing the academic culture will not be easy. However, there are many changes that can be made now to improve the quality and status of teaching and service. Ronald Woodbury urges colleges to reward interdisciplinary activities, by encouraging collaboration of faculty across disciplines in the preparation and delivery of courses. This may take a variety of forms: faculty colloquia, coordinated studies programs, paired and clustered courses, and/or the formation of "learning communities" of faculty and students (Woodbury, 1990). Further, teacher education should be made an integral part of a good graduate education. Making the acquisition of teaching skills an important part of graduate education will improve both the teaching abilities of future faculty, and the status of teaching in the profession (Boyer, 1990; Cheney, 1990; Boyer, 1987; Pew, 1990b).

College and university presidents, professional associations, governing boards, and accrediting agencies each have a role to play in the revitalization of academic life. First, an energetic vision of scholarship will not emerge without strong leadership. Presidents often control discretionary funds which can be used to support experimental projects. Further, through their powers of persuasion they have considerable influence over institutional and public policy, and are uniquely equipped to create a climate in which new visions of scholarship can emerge. Professional associations also play a critical role in redefining the meaning of scholarship (Boyer, 1990). Finally, accrediting agencies and governing boards can aid in this transformation by making standards more flexible and creative. "Campuses," Boyer urges, "should be encouraged to pursue their own distinctive mission, and innovations should be rewarded, not restricted" (Boyer, 1990: 80).

Higher Education and the Public Schools

At a time when high skills and innovation are crucial to economic competitiveness, the United States is falling behind other countries in educational achievement. When compared with students in other industrialized nations, U.S. students consistently score at or near the bottom in mathematics and science (Lapointe, et al., 1989); the majority of students have difficulty interpreting and explaining what they read; and most students in

the U.S. lack a thorough knowledge of American history and culture, or an adequate understanding of other cultures, world geography, and international events (Barrows, et al., 1981; Gallup, 1988; U.S. Department of Education, 1992a).

Why are we falling behind in educational achievement? The National Commission on Excellence in Education (1983) laid the blame squarely at the feet of our educational system. The Commission concluded that "our society and its educational institutions...have lost sight of the basic purposes of schooling, and of the high expectations and disciplined effort needed to attain them." This report, and those that followed it, emphasize the need for our nation's schools to teach all students to master basic skills, reason and think critically and creatively, be informed problem solvers, and connect what they learn in class to the world outside (National Commission on Excellence in Education, 1983; Commission on the Skills of the American Workforce, 1990; Reich, 1991b; U.S. Department of Education, 1991; SCANS, 1992).

The nation's educators and political leaders responded with a myriad of reforms — from strengthening college and university admissions requirements to salary increases for educational professionals, strengthened teacher certification requirements, and placing increased emphasis on early childhood education. Unfortunately, at the end of the decade the Education Commission of the States (1988) concluded that these reforms amounted to little more than "adjustments to the original prototype." No real alternatives were undertaken. The National Education Goals panel, a group of experts brought together by the Bush Administration to analyze the present crisis in education and propose solutions to it, came to a similar conclusion. The panel observed that, despite efforts at educational reform in the 1980s, trends in educational achievement remain flat (U.S. Department of Education, 1991).

Both studies call for radical restructuring of our nation's schools. The Education Commission of the States (1988) urges educators to "challenge the present...conception of schooling [and] turn to changing the system." *America 2000* provides federal start-up funds and urges state and local support of a new generation of American schools which break from standard conceptions of education. Schools and communities are challenged to develop innovative learning environments which produce "extraordinary gains in student achievement" (U.S. Department of Education, 1991).

Reaching these goals requires a commitment from all levels of government, parents, the schools, higher education, and the community. Yet, one partner in school reform remains conspicuously absent from the discussion — higher education. Neither of the major reports on school reform released in the past decade provide a thorough discussion of higher education's role in the reform and renewal of elementary and secondary education (U.S. Department of Education, 1991; National Commission on Excellence in Education, 1983).

This is not a minor omission. Institutions of higher education have a profound influence on the direction of our nation's schools. They prepare educators in substantive knowledge areas, educate them to the proper use of teaching methods, and socialize them to the

teaching profession and the expectations of the larger society. Through research on teaching and learning they promote the active exploration of ideas, seek solutions to emerging problems, and evaluate and provide insights into how teaching methods can be improved.

Unfortunately, critics contend, schools of education tend to support the status quo. The clinical experience of teachers is limited to student teaching under the supervision of a seasoned teacher who socializes them to existing practices. Real change in education is not possible without substantive change in the institutions where the nation's teachers (and those who educate them) are socialized to the profession (Goodlad, 1991; Holmes Group, 1986, 1989, 1990; Task Force on Teaching as a Profession, 1986; AACTE, 1991a, 1991b, 1991c).

Multiculturalism. One factor driving education reform is the emerging multicultural society of the late 20th century. By the middle of the 1990s a majority of the nation's school children will be non-White or Latino (WICHE, 1991a); more than 20 percent of the nation's children live below the poverty level (U.S. Bureau of the Census, 1991); and nearly 30 percent live in single parent households (U.S. Bureau of the Census, 1992). The White, middle-class, two-parent family for which the present system of education was structured, does not reflect the reality of much of American society in the late 20th century. The educational needs of students from underrepresented racial and ethnic backgrounds have not been well-served by the current system (for a discussion of these factors and their effect on teacher education see, Goodlad, 1991).

In 1976 the standards of the National Council for Accreditation of Teacher Education (NCATE) were updated to include a standard on multicultural education. The NCATE standards stress the importance of preparing teachers to work equitably with all students and to utilize pluralistic curricular and instructional techniques (Garcia, 1980; Gollnick, et al., 1980). In order to meet these goals, it has been suggested that teacher education programs require prospective teachers to complete courses on the cultural effects of learning and the cross-cultural aspects of family life; provide them with opportunities to observe and interact with students and families from diverse cultural backgrounds; and expect them to identify and confront cultural misconceptions and their own "personal biases" early in their educational program. Continuing teacher education programs and the schools also have an obligation to help teachers identify their personal biases and develop a better understanding of the diversity of cultures represented in their classrooms. Moreover, the importance of involving members of the local community in the design of teacher education programs and in the development of school programs that forge links between teachers and the culture of the local community cannot be overemphasized. (Mitchell, et al., 1980; Gollnick, et al., 1980; Spears, et al., 1990). In short, multicultural education should be integrated into the day-to-day experience of teachers and be an integral part of pre-service and in-service education.

Math and Science Education. America is producing too few engineers and scientists. The National Science Foundation estimates there will be a shortfall of 400,000 science and engineering personnel by the year 2000. Less than one-half the Ph.D. scientists and

engineers per capita are being produced today as were produced in the early 1970s (Matthews, 1990; Thurow, 1992). Most of the blame for this decline lies in poor mathematics and science education in high school, helping to dissuade students from pursuit of science careers. This is especially true for women and students from underrepresented racial and ethnic backgrounds who are seriously underrepresented in science, engineering, and mathematics careers (Matthews, 1990; Thurow, 1992).

Moreover, the majority of workers must be mathematically and scientifically literate if we are to meet the demands of the new, technology-based economy (Thurow, 1992; Reich, 1991a; Commission on the Skills of the American Workforce, 1990; SCANS, 1991). Unfortunately, according to one recent study, only 6 percent of all adults and only 17 percent of college graduates are able to correctly answer three basic science questions. As a nation, our mathematical literacy is no better. More than four-fifths of high school graduates cannot solve a simple two-step arithmetic problem, and two-thirds of all college mathematics enrollments are in courses normally taught in high school (Thurow, 1991; Steen, 1991).

The responsibility for increasing the number of science and mathematics professionals and the general mathematics and science literacy of our population rests squarely on the shoulders of our nation's teachers, many of whom also lack these basic skills. Only 10 percent of undergraduates enrolled in education programs are able to correctly answer basic science questions (Steen, 1991), and students intending to major in education consistently score below the average college-bound student on the mathematics portion of the Scholastic Aptitude Test (Task Force on Teaching as a Profession, 1986; The College Board, 1991).

These observations lend support to proposals for strengthening the undergraduate mathematics and science curriculum (National Research Council, 1991), and requiring all education majors (elementary and secondary) to acquire a more thorough grounding in the arts and sciences (Task Force on Teaching as a Profession, 1986; Steen, 1991). Goodlad (1991), however, cautions that requiring more coursework in basic mathematics, science, or any other subject matter will not produce better teachers unless this learning is coupled with thorough preparation in and practicing applying teaching methods appropriate to that subject matter.

Restructuring Teacher Education Programs. Teachers are the key to a thriving educational system. It is up to teachers to see that our nation's schools are providing all students with the type of education they need to live and work in the emerging global and multicultural society of the late 20th century. In order to achieve this goal, teachers themselves must be life-long learners, believe and practice a philosophy that all students can learn, and be skilled at building and participating in powerful learning communities at the school level.

How can we ensure that this type of learning environment exists in our nation's schools? Efforts to ensure quality teaching have, for the most part, focused on gatekeeping mechanisms — strengthening teacher certification requirements and mandatory

competency testing for teachers. Many experts argue that these strategies are inadequate to the task at hand. Improving the skills, abilities, and attitudes of our nation's education professionals, and thus improving our nation's educational system, requires a complete restructuring of the education profession from undergraduate and professional education, to state certification requirements, the work environment, pay schedules, and continuing professional education (Holmes Group, 1986, 1989, 1990; Task Force on Teaching as a Profession, 1986; Goodlad, 1991).

Working from this premise, the Holmes Group (1986) — a consortium of education deans and chief academic officers from the nation's major research universities — issued a report calling for the restructuring of teacher education programs. The goal of the Holmes Group is to dramatically improve the quality of America's teachers and the teaching profession by improving undergraduate and professional education programs, developing better methods of assessing professional competence, increasing research on teaching and learning, and collaborating across academic boundaries within the university and between the university and the schools. The Holmes group urges institutions of higher education to focus academic resources on teacher education and make the achievement of a quality educational system a top priority.

Other observers have reached similar conclusions. The Carnegie Forum on Education and the Economy asserts that the key to improving our schools "lies in creating...a profession of well-educated teachers prepared to assume new powers and responsibilities to redesign schools for the future" (Task Force on Teaching as a Profession, 1986: 2). Goodlad (1990 and 1991) also argues that the renewal of schools and the renewal of programs that educate teachers must go hand in hand. Programs that educate teachers must provide them with the tools they need both to deal with the day-to-day activities of teaching, and to lead efforts to renew the schools. For Goodlad, teacher education is one of higher education's most important responsibilities. Institutions of higher education that are not willing to make a strong commitment to teacher education and provide adequate resources for restructuring teacher education programs should not be educating teachers.

A number of specific proposals have been made for strengthening teacher education programs. Most popular among these are: requiring future teachers to complete a liberal arts degree before being admitted to a professional program in education (Task Force on Teaching as a Profession, 1986); and redesigning the clinical experience for future and continuing teachers to include service in "teaching schools" or "professional development schools" (Goodlad, 1991; Holmes Group, 1990).

Students concentrating on elementary education usually are exposed to extensive training in educational methods and limited exposure to subject matters, while secondary education majors emphasize a subject matter and complete only a limited number of educational methodology courses. The Task Force on Teaching as a Profession (1986) contends that both elementary and secondary teachers require more exposure to subject matter content and methodologies. Becoming well-grounded in both, however, is not possible in four years. Therefore, the task force proposed that all students be required to complete a four-year liberal arts degree before applying for admission to a two-year

professional education program. In order for this to succeed, careful attention must be given to strengthening the arts and science curriculum so that prospective candidates enter the education profession with a solid intellectual foundation.

The Holmes Group (1986) supports similar reforms. It calls for a more comprehensive and integrated undergraduate and professional (graduate or fifth-year) education program contingent upon significant improvement in the substance and delivery of the undergraduate curriculum. It is recognized that eliminating the undergraduate education curriculum alone will not lead to improvements in the education of educators. After one-year of efforts to reform teacher education, the Holmes Group (1989) reported that while there had been progress in many institutions toward a more integrated undergraduate and professional curriculum for educators this policy was not without pitfalls. Fifth-year programs run the risk of divorcing liberal education from professional education if there is little or no coordination between liberal arts and education faculty. Therefore, while these programs provide the structure for integration they do not guarantee it will take place.

While Goodlad (1991) agrees that the undergraduate experience for teachers must be strengthened, he is not enamored with proposals for graduate level or extended education programs. Moving weak undergraduate education courses to the graduate level does not improve them. Further, rather than making the education curriculum more comprehensive and balanced by moving them to the graduate level, it is more likely that the study of education will focus even more narrowly on the particular research interests of faculty than they did previously. In Goodlad's opinion, eliminating the undergraduate education curriculum is not a substitute for a "universitywide examination and commitment to programs for the education of educators (Goodlad, 1991: 188)."

Revamping the student teaching experience, on the other hand, has wide support. The second year of the professional program in education outlined by the Task Force on Teaching as a Profession would involve a hands-on clinical experience in a "teaching school" similar in design to a "teaching hospital." Goodlad's (1991) idea of the exemplary "practice" or "teaching" school, and the Holmes Group's "professional development schools" are similar in form and content to the Carnegie model.

The idea of the "teaching" school stems from the belief that the current practice of placing a beginning teacher with a cooperating teacher in a classroom is inadequate. First, the traditional approach focuses on the classroom, rather than on teachers as innovators and stewards of the entire school. Second, as it is currently structured, student teaching does not provide new teachers with sufficient exposure to the variety of school problems, concerns, and cultures they must confront throughout the course of their careers. The "teaching" school concept expands the educational experiences of beginning teachers, practicing teachers, and university faculty alike.

The successful school requires a long-term partnership between the university and one or more school systems. Together university faculty (arts and science, and education faculty) share the responsibility for selecting, maintaining, and developing exemplary "teaching" schools with teachers from their "partner" schools. Each participant splits time between

traditional teaching duties and working with beginning teachers. Teacher-educators are brought into school-based settings where they work directly with school-based educators. School-based educators are given the opportunity to build learning communities in which they can explore teaching and learning in collaboration with their university colleagues. For their part, beginning teachers become interns in the "partner schools" and participate in field experiences in a wide variety of school settings under the direction of a team of university educators and "lead teachers" (Goodlad, 1991; Holmes Group, 1990; Task Force on Teaching as a Profession, 1986).

Numerous experiments with this model are being carried out — the Holmes Group's "professional development schools;" experimental clinical schools supported by the Ford Foundation; and the "partner school" project of the National Network for Educational Renewal. Although these projects hold promise, it is too soon to come to any conclusions about the best way to resolve potential conflicts in "teaching schools" between the schools and the university over control, funding, and the division of labor (Goodlad, 1991). The "teaching school" movement reflects one of the first comprehensive efforts to build viable and productive school/university partnerships. Much will be learned from this experience.

University/School Partnerships. The school reform movement has spawned a growing interest in school/university relationships. Universities, sensing pressure from legislators and the public to be more responsive to the needs of schools, have formed numerous university/school programs in recent years. These programs have taken many forms — from curriculum sharing, to providing college-level instruction to pre-college students, sharing responsibility for educating educators, and sharing new technologies, laboratories, and other facilities (SHEEO, 1991; Gross, 1988; Lieberman, 1988; Greenberg, 1991). The question is whether these programs are based on a long-term, institutional commitment or are merely short-term reactions to public pressure for reform?

Joining individuals, schools, and universities together in a network is increasingly common. These networks provide links for communication between persons and groups with common goals and interests; however, they are not partnerships and cannot have the long-term impact of a true partnership. In fact, most observers agree that long-term partnerships that enjoy university- and school-wide commitment are rare. Goodlad (1988) and Clark (1987) argue that, although the term partnership is used extensively when referring to school/university programs, few programs meet the definition.

Partnerships represent a fundamental restructuring of the university/school relationship. A successful partnership depends on the commitment of all parties to a shared vision for improving education. Maintaining a healthy and productive relationship requires the involvement of faculty and student services professionals from throughout the university; the breakdown of stereotypes and a redefinition of the roles of university faculty and teachers; involvement of K-12 educators as peers and full partners in the planning of applied research and teacher education programs; and a willingness of all participants to put self-interest aside in pursuit of common goals (SHEEO, 1991; Goodlad, 1988; for a detailed theoretical discussion of partnerships and collaboration see Clark, 1987; Schlechty and Whitford, 1988).

Long-term partnerships between schools and universities are necessary if the model "teaching school" is to become a reality. Shifts from basic to applied educational research will lack substance unless projects are jointly developed by school-based personnel and academic researchers, and will be useless unless they can be rapidly applied to the school setting (Goodlad 1991, 1988; Holmes Group, 1990; Task Force on Teaching as a Profession, 1986).

Problems and Prospects. Restructuring teacher education and making partnerships work will require the support of all sectors, including the state government, state education agencies, university leaders, and the business community.

Most experts agree that state leadership is necessary if we are to realize substantive change in the relationship between higher education and the schools. Governors, legislators, and state higher education agencies have a responsibility to create an environment that encourages innovative approaches and to provide financial incentives to support innovation (Goodlad, 1991; Holmes Group 1986, 1989; SHEEO, 1991; AACTE 1991a, 1991b, 1991c; Gross, 1988).

State regulations frequently serve as deterrents to change. Goodlad (1990), among others, argues for more autonomy in the teacher education curriculum and for the school-based teaching professional. While the state has an obligation to establish licensing guidelines, it should not prescribe the teacher education curriculum. Too often teacher education curriculums are dictated by state requirements, and the result is an incoherent curriculum. Teacher education, like law and medical education, should be professionally driven. States are urged to set performance standards based on graduation standards or competency tests, rather than course requirements (Holmes 1986, 1989; SHEEO, 1991). Many argue that states should not dilute the professional standards and quality of the teaching profession by allowing for temporary or "emergency" teacher certification in times of personnel shortages. Bestowing credentials on those who have not demonstrated their ability to become teaching professionals demeans the profession and sends the message that we do not sufficiently value our children's education. In short, states can encourage change by creating a flexible regulatory environment that provides leadership without stifling autonomy and innovation (Goodlad, 1991; Holmes Group, 1986, 1989; SHEEO, 1991; AACTE, 1991a, 1991b, 1991c).

Further, states can motivate change through the power of the purse. Through funding priorities that reward quality teacher education programs and encourage strong university/school partnerships state's provide incentives for change. State's can support teacher education reform by fully funding innovative "teaching" or "clinical" schools. Moreover, states can encourage partnerships by establishing competitive grant programs that encourage collaboration and/or make school/university partnerships a specific budget priority (Goodlad, 1991; SHEEO, 1991; AACTE, 1991a; Holmes Group 1986, 1989).

University leaders, from the president to deans have a special role in encouraging innovation. The American Association of Colleges of Teacher Education (1991b) urges university leaders to create an environment in which teacher education is an institutional

priority; there is a long-term commitment to collaborating with schools; and where collaboration and innovation are recognized and rewarded. In part, this means implementing faculty reward structures that recognize and provide incentives for research on pedagogy, school-based research, and collaborative activities; and encouraging the hiring of faculty who have expertise in pedagogy, and a strong commitment to collaboration and innovation. University leaders also must be willing to reallocate institutional resources away from programs and activities that support the status quo into areas where they will be used to restructure teacher education.

Business can play a supportive role. Corporations have a vested interest in starting programs that lend support to teacher education reform efforts. By forming partnerships with teacher education programs, business can help teachers understand the practical applications of the skills they teach. They also can further innovation by underwriting school/university partnerships, supporting school-based research, providing scholarships to future teachers, and supporting programs that encourage students from underrepresented racial and ethnic groups to enter the teaching profession (AACTE, 1991c).

Rethinking the Research and Public Service Mission

Preparing a well-educated labor force is not the only way institutions of higher education contribute to the economic and social well-being of the nation. Through its research and service functions, higher education also plays an important role in strengthening the nation's military capacity, improving public health, and enhancing the competitive position of business and industry.

Influenced by the great European universities, research became a major focus of the American university at the turn of the century. However, it was during World War II that academic research assumed a major role in finding solutions to important social problems. Innovations developed during the war, such as synthetic rubber and electronics, were instrumental both in the allied victory and the economic prosperity that followed. After the war a new relationship was forged between the federal government and the university. Funding for basic research at the nation's universities increased dramatically, nearly tripling between 1958 and 1968. Academic researchers began working on cures for cancer and heart disease, and research needed to win the space race, and strengthen the nation's military deterrence (Brown, 1985; Government-University-Industry Roundtable, 1989; Boyer, 1990; National Science Foundation, 1982; Reams, 1986). Federal funding of research and development increased 100 percent between 1960 and 1970. By 1970, universities accounted for approximately 12 percent of all research and development conducted in the U.S, and more than half of all basic research (Battelle, 1991).

Universities continue to play an important and increasing role in research and development. By 1991, university research accounted for approximately 15 percent of all research and development in the U.S. Moreover, research universities play a significant role in state and regional economic development. Research universities have been instrumental in spawning new and attracting existing high technology industries to their

areas. Colleges and universities also supply the educated personnel, innovations and technical expertise, and the national and international reputation that high technology industries seek (Smilor, et al., 1988; Gibson and Smilor, 1991).

However, as we enter the 21st Century changes are occurring which may result in permanent changes in the relationship between academic research, government, and business and industry. First, funding and performance of academic research are becoming more diversified. While federal funding is still a major source of funds, since 1981 industry has become the dominant funder of research and development. Industry's share of research and development funding increased from around one-third in 1960 to slightly more than one-half in 1991. University-based research and development continues to be funded primarily by the federal government, but industry involvement in this sector also appears to be increasing (Battelle, 1991). The federal share of academic research declined from 66 percent to 60 percent between 1978 and 1988, while the share of university-generated and industry-sponsored funding grew substantially (Government-University-Industry Roundtable, 1989).

It is not clear, however, whether support for academic research will continue at present levels. Government and industry are beginning to question the value of university-based research. The emerging global economy and society of the late 20th Century depends on innovation and the ability to quickly transfer research from the drawing board to the marketplace (Business-Higher Education Forum, 1983; Thurow, 1991; Carnevale, 1991; Reich, 1991b; Powers, et al., 1988; Gibson and Smilor, 1991). Unfortunately, basic university research can take years from discovery to commercialization, and may never be successfully transferred into the marketplace. Battelle (1991) predicts that industry may curtail some of its support for academic research and shift resources to short-term and in-house contracts as the need for the rapid turnaround of research into products and processes increases.

Further, the love affair between research universities and state governments seems to be cooling. In the 1980s many states invested heavily in economic development plans based on research grants to universities. These programs are losing their appeal, as states suffer recessions and tight budgets and seek activities that will have a more immediate and direct impact on business and industry (Blumenstyk, 1992).

University Research in the 21st Century. The future of university research will be determined in large part by the ability of institutions to forge new and stronger relationships with government and with business and industry. These relationships include collaboration with business and industry, the management of university research (patents, venture capital, spin-off companies), and the involvement of foreign firms in university research.

Collaboration with business and industry. Decreased state and federal funding are encouraging universities to seek stronger relationships with business and industry, and to capitalize financially on faculty innovations. Universities are expanding their involvement in the commercialization of basic research in a variety of ways, including

forming consortia, industry/university partnerships, new business incubators, spin-off corporations, and licensing (Brett, et al., 1991; Smilor, et al., 1986, 1988). Consequently, the research and service missions of the university have become increasingly intertwined, and the distinction between basic and applied research has become increasingly blurred.

Powers and his colleagues (1988), citing a 1983 report by the U.S. General Accounting Office conclude that colleges and universities that engage in any of the following activities can claim to have fulfilled their service mission:

- facilitate basic research which makes new products and processes possible;
- increase the rate at which scientific and technical knowledge and understanding are adapted by industry;
- make sophisticated facilities and equipment available to scientists and engineers in industry and universities;
- orient university research more toward industrial needs and opportunities (e.g., interdisciplinary research);
- increase the quality of graduate training of industrial scientists and engineers;
- increase the rate of establishing new businesses that exploit science and technological developments and improve their capacity to survive; and
- increase the capacity of financially constrained businesses or industries to take advantage of scientific and technical developments.

Of course, the type of collaborative activity an institution engages in will depend on its mission. Community colleges primarily are involved in training and retraining for specialized skills. Four-year institutions provide technical assistance to small and emerging businesses and degree-level training, and graduate institutions are a major source of basic research and technical assistance (Powers, et al., 1988).

Management of University Research. Serious questions have been raised about the potential effects of industry's partnerships with colleges and universities. Is higher education straying from its mission? Is there a conflict of interest between the university's pursuit of knowledge and industry's interest in commercial development? Does faculty involvement in commercial enterprises that benefit from their research compromise their integrity and divide their loyalties? Will contractual relations with business and industry limit the ability to publish and disseminate research findings? Under what circumstances are the interests of graduate students negatively affected by their involvement in corporate-sponsored research? Is the university favoring large national corporate interests to the detriment of smaller local and regional industries (Enarson, 1982; Fairweather, 1990; Brown, 1985; Garrett, 1985; Reams, 1986; Matthews and Norgaard, 1984)?

Changes in the patent laws, as well as federal tax incentives for industry sponsorship of research, have broadened the scope of university involvement in corporate research. Under the Uniform Patent Law of 1980 colleges and universities are responsible for obtaining patents and for licensing and marketing patented discoveries from federally sponsored research. Universities, therefore, can retain title to patents arising from this research. This increased involvement in the commercialization of discoveries has led some institutions into venture capital markets and limited partnerships with faculty and outside industries. Colleges and universities have set up business incubators, often in cooperation with venture capital groups, 'spinning off' new industries from faculty research discoveries (Brown, 1985; Brett, et al., 1991). While these activities frequently yield additional revenues for universities, they put higher education institutions into the business of licensing patents for commercial use, and/or makes them a direct partner in risky commercial ventures.

Within this context, colleges and universities have an obligation to ensure that the academic values of the institution are not threatened (Reams, 1986; Enarson, 1982; Brett et al., 1991). Most observers agree that, with proper management, it is possible to enter into university/industry relationships while protecting the interests of both the university and industry. In order to maintain the integrity of the institution and avoid conflicts-of-interest, Reams (1986) suggests that the contents of all university/industry contracts be made public through public disclosure and/or the formation of faculty review committees. Further, Harold Enarson (1982) cautions colleges and universities not to be party to contracts that prohibit the scholarly publication of research findings; and calls on them to protect graduate students from situations in which they feel they must participate in a project that is not in their best academic interest (see also, Varrin and Kukich 1985).

In 1991 Brett and his colleagues concluded that the increased presence of industrially sponsored research at universities had not detrimentally affected basic research or teaching. Moreover, they argue that through the strategic management of research and its commercialization universities are moving into an important new role. In order to avoid potential conflicts of interest, they suggest institutions formulate and make public formal intellectual property and conflict of interest policies. These policies should clearly specify guidelines for faculty use of university resources, faculty obligations to fully disclose their outside consulting activities and financial interests; establish the distribution of royalties between the faculty member, his or her academic unit, and the university; and establish procedures through which patents and commercial licenses will be negotiated.

For all of the problems inherent in university/industry relationships, few argue for eliminating these collaborative arrangements. Enarson (1982) stresses that relationships with business and industry, while problematic, are valuable. The Business-Higher Education Forum (1988: 9) applauds universities for their cooperation with industry in research and technology transfer and emphasizes the value of these relationships in "mak[ing] America more competitive at home and abroad,...strengthen[ing] the science and technology base of the nation,...advanc[ing] knowledge, and...respond[ing] to budgetary and financial pressures."

Involvement of Foreign Firms in University Research. One of the most heated issues involves relationships between university research and foreign commercial interests. According to a recent study by the Center for Public Integrity, Japan invested more than \$4.5 billion in U.S. educational and academic research in the 1980s (Epstein, 1991). Through their agreements with American research universities, they argue, foreign firms are exploiting intellectual resources; securing economic advantages over American firms by gaining immediate access to research findings; influencing public policy in the U.S. in their favor; and influencing American public opinion. Moreover, since most university research receives state and federal funds the American taxpayer is subsidizing the efforts of Japanese businesses. The center argues for the "[c]reation of a national commission to examine foreign financial participation in scientific research in U.S. colleges and universities, foreign sponsorship of what is taught in American schools, and foreign support for U.S. policy research establishments" (Epstein, 1991: 2).

However, this view is not universally shared. Reich argues that involvement by foreign firms in research and development activities in the U.S. has a long-term net benefit for the United States. During the 1980s foreign-owned firms invested more per U.S. worker in research and development than the average American firm. Further, American firms also invest heavily in research and development activities in other countries. These global firms, American and foreign-owned, often purchase innovations in one country, and put the innovation into production in another country for export to the rest of the world. Finally, he argues, "the primary value in [new technologies] is in the skills and insights needed to create them." These skills are the nation's key technological asset, and are lost only if they are not nurtured. In many cases, cumulative knowledge would be lost if foreign-owned concerns did not provide the financial support for research (Reich, 1991: 150-152).

Financing Higher Education

During the past decade, state budgets have been increasingly burdened by federal mandates to expand Medicaid coverage and services, an explosion in the cost of medical services, and rising costs for corrections spurred by increasing prison populations and court mandates to eliminate overcrowding and improve conditions (Gold, 1989). Growing resistance to tax measures by citizens, coupled with a recession, limited the states' ability to raise additional revenues to meet these burdens.

In such austere times, higher education finds itself competing for shrinking resources with other state-funded services, including elementary and secondary education, corrections, and health care. Most of these programs have two distinct advantages over higher education: (1) they appear to address more pressing and immediate social needs; and (2) in some instances, minimum levels of state support are set by federal or court mandates. Funds for higher education, on the other hand, are viewed as discretionary and additional dollars can be raised from tuition increases (WICHE, 1992a).

For fiscal years 1992 and 1993, state appropriations to higher education declined in real dollars between 1989 and 1990 (Hines, 1992). Moreover, 57 percent of the nation's

institutions of higher education suffered mid-year budget reductions in 1992 (El-Khawas, 1991). Since it is doubtful that demands on state treasuries will abate, or that the national aversion to tax increases will soon be overcome, the current financial conditions in higher education are likely to continue.

Institutions of higher education have responded by reducing expenditures on capital improvements and equipment, reducing course offerings, increasing class size, raising tuition, and aggressively seeking external funding sources (El-Khawas, 1991; WICHE, 1992; Harney, 1990 and 1991). While these responses may result in short-term savings, in the long-run they are likely to have detrimental effects on the ability of institutions to meet their missions. Critics argue, cut-backs should not proceed without "in-depth examinations and frank discussions about continuing the health and vitality of higher education in the face of declining resources (WICHE, 1992a: 1)." Paramount among the policy considerations guiding this discussion are: determining the appropriate share of costs to be borne by the state and students; balancing the competing demands of access and quality; focusing institutional roles and missions; and finding new ways to manage costs and increase productivity.

Shifting the Burden. In 1973, the Carnegie Commission on Higher Education raised a fundamental question about the financing of college costs: "Who pays? Who benefits? Who should pay?" This issue, as it was phrased almost 20 years ago, continues to be relevant today. Rising tuition, tight state and federal budgets, and the perception that higher education costs are out of control have reopened this debate.

In the 1980s tuition and fees increased at double the rate of inflation and outpaced increases in family income (NACUBO, 1991d; Hauptman 1990; Hauptman and Merisotis, 1990; Gilley, 1991). The share of costs borne by students and their families increased substantially — from 21 percent of the public higher education budget in 1980-81 to 25.7 percent in 1990-91 (SREB, 1992).⁵ Since 1983, resident undergraduate tuition and fees in public four-year institutions in the West increased more than 130 percent (WICHE, 1992b).

Tuition increases in the 1980s can be traced to several factors (1) the increasing cost of a college education, (2) the declining size of the traditional college-going population, and (3) dwindling state and federal appropriations.

Inflation in the price of goods and services have placed increasing pressure on higher education costs. Personnel costs which make up 70 to 90 percent of higher education costs increased faster than inflation in the 1980s (Gilley, 1991). Rapidly rising health insurance costs; increases in faculty and staff salaries in the 1980s to make up for salary

⁵These percentages were calculated based on local and state appropriation and tuition revenues. There revenues are the sum of (1) state higher education operating appropriations excluding funds for research, agriculture, and medicine; (2) local appropriations; and (3) net tuition revenues (total tuition revenues minus student aid).

losses due to the hyperinflation of the 1970s; and competition for faculty — due to an undersupply of new faculty, pending retirements of large numbers of faculty hired in the 1950s and 1960s, and competition with private industry for Ph.D.s — have contributed heavily to rising personnel costs (Parnell, 1990; Hauptman, 1990b). Further, maintaining the quality of education requires a sizeable investment in new technologies, scientific equipment, and facilities. In the 1980s the price of library materials, information technologies, and scientific equipment increased rapidly. Moreover, institutions that deferred maintenance on facilities and equipment in the 1970s, found it necessary to make a significant investment in the repair and restoration of infrastructures in the 1980s (Parnell, 1990; Gilley, 1991; NACUBO, 1991a).

In addition, level enrollments in the 1980s made it difficult for both public and private institutions to spread increasing fixed costs over growing enrollments, as they had done in the past. Moreover, attempts to maintain enrollments by attracting non-traditional students increased recruitment and student support costs (Werth, 1988; Hauptman, 1990b). Consequently, per student costs increased significantly in the 1980s (Parnell, 1990; Hauptman 1990b; Gilley, 1991).

At the same time, dwindling revenues from the state and federal government placed additional pressures on college and university finances. Between 1990 and 1992 state appropriations to higher education declined in real dollars (Hines, 1992). Federal funding also has declined. Although the amount of federal funding increased between 1975 and 1985, the federal share of higher education revenues fell from 16 percent to less than 13 percent. The state and student shares of higher education revenues increased to make up for shortfalls in federal funding (NACUBO, 1991c).

The declining federal investment in financial aid has transferred some of these costs to institutional budgets. In the 1980s, federal funding for student aid barely kept pace with inflation. Between 1980 and 1986 the number of eligible students receiving Pell grants fell from 31.5 percent of total students to 16.9 percent; and the average amount of grants in constant dollars fell from \$1,414 to \$1,214. Meanwhile, institutional student aid increased from \$1.5 billion in 1977 to more than \$5 billion in 1986 (Parnell, 1990).

As we enter the 1990s, the call has gone out for a fundamental restructuring of how we pay for higher education. Due to shortfalls in state budgets in the 1990s, institutions of higher education will not be able to depend on increases in state support to make up for increasing costs and dwindling federal funds. The most common short-term solution has been for states to move away from an implicit, if not explicit, understanding of the relative cost of education to be borne by students. Tuition increases have been used to fill the gap between rising costs and stable or declining state and federal appropriations. Consequently, the share of total educational costs covered by tuition and fees (before financial aid) increased from 31 percent in 1980-81 to 34 percent in 1985-86 (NACUBO, 1991a).

New Tuition and Financial Aid Models. The model of high public tuition and high student financial aid has been advanced, according to Frederick Fischer, because the low-

tuition policies followed by most states are "inefficient, inequitable, and ineffective" (Fischer, 1990:44). Although high tuition/high aid proposals differ on specifics, they share the assumption that direct state subsidies to public higher education should be severely reduced, tuition and fees at public institutions should be raised to fill the gap between reduced state funding and the cost of education, and more public funds (state and/or federal) should be channeled into direct grants to low-income students attending either public or private institutions (McPherson and Schapiro, 1991; Fischer, 1990). First, it is argued, direct state subsidies to public higher education represent a discount to all students regardless of income. Low-tuition, therefore, is a transfer payment that disproportionately benefits the more financially advantaged (McPherson and Schapiro, 1991). Second, higher tuition and fees at public institutions will lower state spending and create a more competitive environment in which institutions of higher education will be compelled to improve quality and productivity (McPherson and Schapiro, 1991; Fischer, 1990). Third, while our present system of higher education finance enables almost everyone to pursue some type of postsecondary education, it does not give low-income students the full-range of educational options enjoyed by their higher-income peers. Most low-income students are limited to nearby, lower-cost community colleges. A high tuition/high aid policy would narrow the difference in tuition prices between public and private institutions (McPherson and Schapiro, 1991). Finally, removal of state subsidies for middle and upper class students is justified by the argument that higher education is essentially a "private good." The benefits of a postsecondary education, it is argued, accrue primarily to the individual participants. Society's interest in subsidizing higher education is limited to equalizing opportunities for low-income students. Therefore, it is fair to expect more of the costs of higher education be borne by middle- and upper-income students (Fischer, 1990).

There are other reform proposals under consideration. Art Hauptman (WICHE, 1992a) believes that state and higher education policymakers need to move away from thinking of tuition as the "plug" that fills the gap between state appropriation and institutional need (WICHE, 1992a). Critics of tuition-setting methods that use tuition to fund the deficit between institutional costs and all other sources of revenue are concerned that increasing costs and dwindling state and federal funds will send tuition rates spiraling. According to Hauptman (1990b), allowing tuition and fees to rise rapidly, without accompanying increases in financial aid, may have a widespread impact on access and quality. Although rising tuition prices did not significantly affect demand for higher education in the 1980s, Hauptman states, "basic economic theory suggests that at some point higher prices must dampen the demand for higher education (see also NACUBO, 1991b)."

At a recent conference, higher education leaders and experts on higher education finance discussed several proposals for controlling rising tuition. Among them are:

- (1) tying tuition increases to the general economy;
- (2) tying tuition increases to financial aid increases; and
- (3) tying tuition to a percent of the cost of education (WICHE, 1992a; Pew, 1992).

Hauptman puts these proposals in perspective. During the past decade two things have happened that make reform of tuition policies a priority. First, increases in financial aid have not kept up with increases in tuition. Second, public "flagship" institutions have become more gentrified. Upper income students, increased their representation on public flagship campuses during the decade. As a consequence lower and middle income students are either being forced into the lowest cost institutions or squeezed out of higher education altogether (Pew, 1992).

How can this situation be turned around? Hauptman (Pew, 1992) presents a four-part argument for tuition policy reform. First, without adequate financial assistance access to higher education is limited for lower and middle income students. Therefore, increases in tuition should be tied to increases in financial aid. The federal government, states and institutions must work in partnership to ensure that student financial aid for higher education keeps pace with tuition increases. Federal aid should rise in conjunction with increases in tuition, and states and institutions should provide the balance. Second, the ability to pay for higher education would stabilize if tuition increases were tied to the economy (e.g., as a percent of median income or per capita income within a state or by the Consumer Price Index plus a fixed percent (WICHE, 1992a)) rather than to the cost of education. There are, of course, problems with tying tuition increases to the economy. When times are bad institutions that suffer shortfalls in state appropriations, and declining private grants and gifts will not be able to make up the difference by raising tuition. To account for this problem, Hauptman (Pew 1992) proposes that states and institutions adopt a system of reserves and counter-cyclical debt financing. When times are good states and institutions could put money aside. When times are bad institutions then could draw on reserves or make up for budget shortfalls by incurring debt to be paid back in better times. Finally, Hauptman (Pew, 1992) asks states and institutions to consider reexamining enrollment-driven funding formulas. More consideration should be given to incentive funding, challenge grants, and incentives to schools that downsize.

Many other proposals have been made in recent years for helping students and their families meet the tuition bill. Among these are:

Savings and guaranteed tuition plans, e.g., prepayment plans and tax deferred savings bonds (Hauptman, 1990a; Merisotis, 1991);

Worker trust funds for education and training, e.g., a 1 percent federal tax on businesses for employee training, and a worker's education and training fund (Senate Committee on Labor and Human Resources, 1992; Longanecker in Pew, 1990);

Restructuring of the student loan programs, e.g., direct student loans for education from institutions, reduced federal subsidies, non-need based loans for middle income families, mortgage-backed student loans, (Hauptman, 1990a; McPherson and Schapiro, 1991; Merisotis, 1991; Wofford, 1990);

Increasing Pell grant awards and making the program an entitlement (Senate Committee on Labor and Human Resources, 1992);

Public/community service-based aid program, e.g., national service plan, campus compact (Newman, 1985; Merisotis, 1991; Hauptman, 1990a; Stanton, 1990); and

Guaranteed access plan, e.g., New York's Liberty Scholarships (Merisotis, 1991).

Arguments for student aid reform have focused not only on increasing economic efficiency and access, but on the effect various types of aid have on academic performance and future student choices. Loans have come to be the primary means of financing a college education — in 1991-92 guaranteed student loans made up 45 percent of all student aid (College Board, 1992). However, few view the increasing reliance on loans as positive. Loans have been shown to bring about higher rates of attrition than other forms of aid; they may push students away from teaching and other public service jobs and toward high wage jobs; and they may limit the ability of students to make consumer purchases after graduation (Newman, 1985; Hartle, 1991). Grants, on the other hand, are generally thought to have a positive effect on access and persistence (Newman, 1985; Hartle, 1991; Stampen and Cabrera 1986; Stampen, et al., 1988; Hossler, 1984). Work-study has been shown to build character, increase knowledge of job opportunities, develop skills, and instill a sense of civic responsibility in students (Newman, 1985). Moreover, campus-based work experiences increase a student's contact with faculty and administrative staff leading to a greater integration into the campus community. In fact, work-related aid programs have been shown to be a factor in increasing the persistence of low-income students (Olivas, 1985; Stampen and Cabrera 1986, 1988, Hossler, 1984).

There is no consensus on the most effective tuition and financial aid policy; however, most agree that policy outcomes should correspond with institutional and state access goals.

Managing Resources. Increasing tuition rates, the rising cost of instruction, oversubscribed courses, difficulties in finding employment with "only" a bachelors degree, classes taught by graduate students, and faculty research on "abstract" topics have begun to foster a public environment of distrust in the quality and integrity of higher education. Many have argued that trust can only be regained through a complete restructuring of the enterprise (WICHE, 1992a; Pew, 1990b, and 1989; Knerr, 1990; NACUBO, 1991b; Gilley, 1991; EcKaus, 1990).

Many of the suggestions for a new system of higher education have been addressed earlier in this paper. They include:

renewed emphasis on teaching;

applied research addressing state needs;

attention to the higher education's public service function;

greater balance in the curriculum between the world of education and the world of work;

greater attention to serving the educational needs of underrepresented populations;

making more efficient and effective use of educational technology including telecommunications;

infusing an international and multicultural perspective into the curriculum;
and

developing stronger partnerships with the public schools.

These changes will not come comfortably or easily to higher education, and they will require a new approach to managing higher education resources.

Budget difficulties of the early 1990s are likely to continue for some time - neither state nor federal funding is likely to increase, and there is a limit on the costs that can be borne by students. Proceeding with business as usual is likely to have serious consequences. Even in the eighties, during a period of relatively more favorable funding, many colleges were deferring building maintenance and replacing equipment. Estimates of needed capital investment to repair and replace higher education's crumbling infrastructure exceed \$60 billion (NACUBO, 1991a). Today there is less consideration being given not only to infrastructure but also to curricular reform (program development and development of new courses) and to the development of human assets (sabbaticals and faculty development). Similarly, there is little willingness to engage in discussions about investing in new technology needed to effectively implement distance education (WICHE, 1992; Harney 1990, 1991). As a consequence past investments are being eroded and nothing is being done to reshape the asset structure to serve future needs.

There is growing consensus within the higher education community that a new resource management model is needed; one based on institutional differentiation and an acceptance that campuses can not be all things to all people (WICHE, 1992a; PEW, 1989, 1990, 1991, 1992; Langfitt, 1989; Gilley, 1991). Limited resources require that the current mission drift be reversed, and policies that foster this drift be examined, policies such as faculty reward systems that emphasize basic research over teaching and applied research, and state budget formulas that provide more dollars to research than comprehensive universities. Higher education must become more focused and more accountable. Cost-plus pricing policies should be abandoned and institutions should "grow by substitution" rather than accretion (PEW, 1990b). This new resource management model will require tough decisions and the support of all segments of the higher education community.

Rapid economic, social, and demographic changes, and limited fiscal resources are placing new and additional demands on higher education. Meeting the economic and social challenges that lie ahead require state and higher education leaders to rethink current policies and practices and embrace a new vision of higher education.

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